AN EXPERIMENTAL STUDY OF THE EDUCATIONAL INFLUENCES OF THE TYPEWRITER IN THE ELEMENTARY SCHOOL CLASSROOM

WOOD AND FREEMAN

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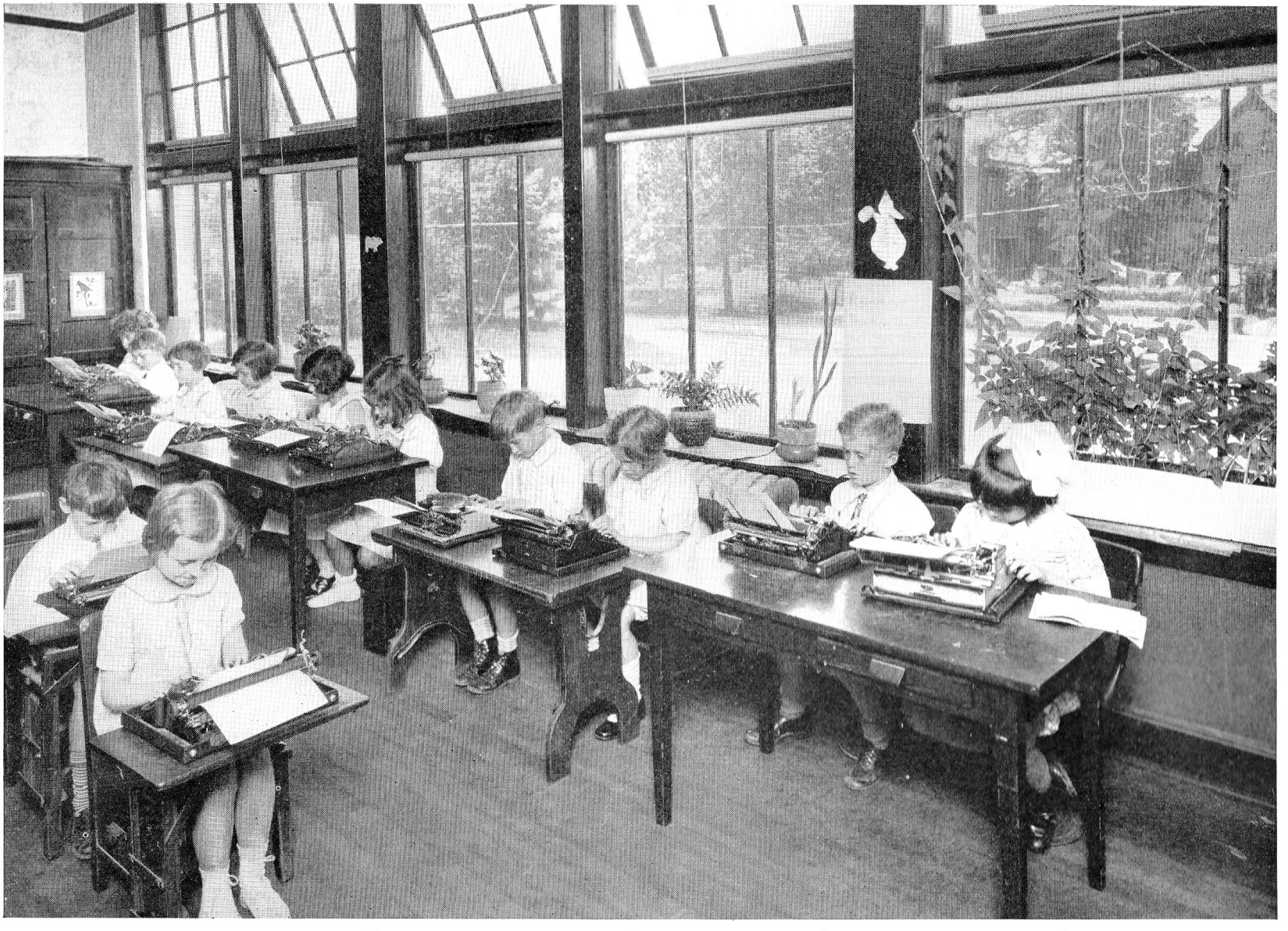

PLATE 1. THE TYPEWRITERS IN A SECOND-GRADE CLASSROOM

Typewriters are used on various kinds of tables and desks. When not in use, the typewriters are stored in the lock cabinet at the rear. In some rooms steel cabinets were used, and in others wall-closets.

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It is with particular pleasure that we take this opportunity to extend our thanks to Mr. J. Lee Sweeney, Director of the Typewriter Educational Research Bureau, and to the four constituent companies for a third subvention which they have just made as this report goes to press, for the purpose of enabling us to make a more complete study of some of the detailed problems that have arisen in the course of two years of experience with the classroom typewriter. It is hoped that with this third subvention, and the continued loan of a sufficient number of the typewriters to continue the experimental work in most of the schools that have participated thus far, we may contribute something toward a clarification if not a solution of some of the questions raised, but necessarily left unanswered, in the report that follows.

Our debt to the Superintendents of Public Schools in eight cities and to the Headmasters of the participating Independent Schools, and to their administrative associates and supervisors, for giving us the Experimental and Control schools in which to carry on the experiment, and for their efficient and cordial coöperation in the conduct of the experiment, is so large that no expression of thanks can be adequate. It is due in no small measure to their intelligent interest and painstaking care and administrative foresight that so large a project as this, involving the testing and retesting of several thousand children in a dozen cities, has been carried forward without hindrance and with a remarkable record of successful follow-up of identical groups of students through two full school years.

Our debt to the teachers in charge of the Experimental and Control classes is also beyond our powers of expression to acknowledge adequately. In the last analysis, whatever success the experiment has enjoyed in contributing to our knowledge of this proposed new classroom instrumentality, is due to the patience, integrity, and ingenuity of the teachers who have so devotedly carried on in the front line of the investigation. To them we offer our heartfelt thanks for their part in the experiment and for the privilege of having observed their work in their own classrooms.

Many individuals have contributed time and thought to the investigation. We offer our hearty thanks to Mr. F. N. Kondolf, organizer and for a time Director of the Typewriter Educational Research Bureau, for cordial coöperation in laying our request for funds before the four companies; and for invaluable aid in organizing the administrative aspects of the investigation; to Dr. Rollo G. Reynolds, Principal of Horace Mann School, who has served as administrative adviser to the directors of the investigation; to Dean J. C. Knode, now of the University of New Mexico, for his efficient service as Field Director of the investigation in the spring and summer of 1929, and for his coöperation in visiting the Experimental school in Albuquerque, and consulting with the Experimental teachers throughout the investigation; to Dr. Ralph Haefner, Field Director since the summer of 1929, and author of "The Typewriter in the Primary and Intermediate Grades," for services too numerous to mention and too valuable for adequate acknowledgment; to Mr. E. W. Barnhart, Director of the Commercial Education Service of the Federal Board for Vocational Education, for much helpful advice and aid in planning the early stages of the use of the typewriters by children in the classroom, and in giving instructions and helpful suggestions to the Experimental teachers; to Mr. Richard Warren, statistical consultant of the Columbia University Statistical Bureau, for aid in planning and for carrying out the statistical analysis of the test data; to Mrs. Ruth McJimsey for organizing the analysis of the children's writings presented in Chapters IV and V; to Mrs. Lide and Mrs. Hoppes for their very efficient help in conducting the experiment in the laboratory schools of the University of Chicago, and in the public schools of Chicago; to Geraldine Spaulding for help in preparing and correcting the manuscript of this report.

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B. D. W.
F. N. F.

INTRODUCTION

We have witnessed in recent years a rapid increase in the use of the typewriter in private life as distinguished from business. This extension of the private use of typewriters immediately suggests to educators the question whether the school should not present the opportunity to all pupils, and not merely to commercial students, to learn the use of the machine.

A second, less obvious but perhaps more important, consideration is the value which the typewriter may have as an instrument in carrying on the various learning activities in the school. It seems quite probable that the acquisition of skill on the typewriter would serve not merely the practical purposes of later life, but would also serve as an efficient tool in achieving the normal and accepted aims of elementary school education.

In spite of the obvious difficulties of introducing the typewriter into the elementary school, a number of informal experiments in the use of the typewriter in the grades have been made in private schools. The determination of the value of the typewriter as an instrumentality of learning is such a large undertaking, and the prior establishment of this value is so desirable as a prerequisite of any effort to promote the extensive introduction of typewriters into the elementary school, that the importance of a large-scale experiment is obvious.

Four typewriter manufacturers who make portable typewriters, recognizing the importance of such an investigation and recognizing also their common interest in the matter, authorized in 1929 the appropriation by the Typewriter Educational Research Bureau of a sum of money large enough to support an extensive investigation of the educational effects of the use of the typewriter in the school. This appropriation, followed by additional appropriations in 1930 and in 1931, was made in the form of a trust fund and was made available to the directors of the investigation with entire freedom to proceed in accordance with the dictates of the principles of rigid experimentation.

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AN EXPERIMENTAL STUDY OF THE EDUCATIONAL INFLUENCES OF THE TYPEWRITER IN THE ELEMENTARY SCHOOL CLASSROOM

CHAPTER I

PURPOSE AND PLAN OF THE INVESTIGATION

Purpose

The main purpose of this investigation was to study the nature and extent of the educational influences of the portable typewriter when used as a part of the regular classroom equipment in the kindergarten and elementary school grades. It cannot be too much emphasized that we are concerned with an educational investigation and not an investigation of typewriting as an end in itself. The typewriter has been studied as an instrument in the performance of activities already required by the existing curriculum, not as an instrument in a new course of study. The speed and accuracy with which our Experimental children have learned to write on the typewriter have been observed and studied carefully, but we have been interested in the speed and accuracy of typing only as these are instrumental and incidental to the usual goals of classroom and home exercises. This emphasis does not mean that the acquisition of typing skill does not have direct value. Such value may be assumed. It is additional to the types of values studied in this experiment.

A second purpose, coördinate in importance with the first, was to study the pedagogy of the typewriter as a classroom instrumentality. At the outset of the investigation no one could suggest with any confidence ways and means of introducing the typewriter to the children, to say nothing of organizing and fitting the use of the machine into the other classroom activities throughout the school session. The teachers were given great freedom throughout the whole course of the experiment in working out ways of adapting the typewriter to the regular classroom activities. Quite expectedly some teachers hit upon obviously good ways and some teachers hit upon obviously bad ways of using the typewriter. Since our purpose was to study the educational influence of the typewriter when used in the best possible way that could be developed during the early stages of the investigation, the problem of observing and collating the experiences of the Experimental teachers was an important one.

Scope of this report. The present report is restricted exclusively to a presentation of the evidence which has been collected on the nature and extent of the educational influences of the typewriter when used as a part of the regular classroom equipment in elementary school grades. The question of the pedagogy of the typewriter when so used is so complex and so important that it clearly requires a separate and detailed treatise. Such a treatise has been prepared by Dr. Ralph Haefner, who has served as Field Director of this investigation since the summer of 1929. It will be published under the

title *The Typewriter in the Primary and Intermediate Grades* simultaneously with the present report. While Dr. Haefner's treatise is an independent contribution and is published in a separate volume, it should be considered as a most important part of the report on the typewriter investigation.

Plan of the Investigation

Experimental and Control groups. In studying the educational influences of any classroom instrument, the essential desideratum is to compare the educational progress of large groups of children who have enjoyed its advantages for a considerable period of time with that of large groups of children who have not had its advantages, all other conditions affecting educational progress remaining as nearly normal and as nearly equal as possible for the two groups compared. Throughout this report the former children will be referred to as the Typewriter or Experimental group, and the latter as the Control group. These identifications will sometimes be abbreviated: the Typewriter or Experimental group will be called the T or X group, and the Control the C group.

Among the important conditions which should be equal for the Experimental and Control groups are the following: general character of the Experimental and Control schools; training, experience, and ability of the Experimental and Control teachers; curriculum opportunities in the Experimental and Control schools; the social, economic, and racial background of the children; and finally, the learning capacity and initial achievement of the children in the two groups compared. Detailed evidence on the extent to which equality was achieved in these various respects will be presented later. The fundamental element in the plan of our investigation, therefore, was to compare the educational gains of two groups of children whose educational opportunities differed in no important respect except that one group had the use of the typewriter.

Duration of the experiment. In order to be significant the comparison between the Typewriter and Control groups must be in terms of gains made over a considerable period of time. In studying so fundamental a matter as a new way of writing, one full school year would probably be a minimum period in which valid and reliable quantitative indications might be obtained. Accordingly, this investigation was originally planned for one school year, September 1929 to June 1930, and the first subvention was secured through the agency of the Typewriter Educational Research Bureau for carrying out this plan.

Preliminary analysis of the first year's data during June and July 1930 gave such favorable indications of the values of the typewriter throughout the elementary school grades that further experimentation was clearly warranted. Both teachers and pupils were enthusiastic about continuing the use of the machines. Many detailed problems of the pedagogy of the typewriter at various grade levels came to light along with the favorable indications. The availability of a large group of teachers and of several thousand pupils with one year's experience with the typewriter created a unique opportunity for constructive research. The superintendents of schools and the headmasters urged the desirability of taking advantage of this unique opportunity by continuing the investigation.

The whole matter was laid before the Typewriter Educational Research Bureau and the four constituent companies, with the result that a second subvention was made, in the same form and manner as the first, to enable us to extend the investigation through another school year, September 1930 to June 1931. It is due to this second

subvention, and the continued loan of the machines (of which the number was augmented to about twenty-one hundred), that we are enabled to base this report on the classroom use of the machines through two full school years.

Types of Evidence

While, as already indicated, this investigation was organized to deal primarily with the comparative educational gains of the Typewriter and Control children as measured by acceptable achievement tests, it seems obvious that test results alone cannot possibly reflect all the influences, direct and indirect, of an instrument which touches such fundamental aspects of school life as writing and the organization of the classroom as a social unit. We are depending on three other major types of evidence, in addition to the test results: the children's writings, the teachers' judgments, and, last but not least, the testimony of the children themselves. The impossibility of securing any objective and comparable measurements in the kindergarten, and the limited test results obtainable in the first grade, force us to depend almost entirely on these last three types of evidence in judging the influences of the typewriter on these very young children. The following paragraphs describe briefly the four types of evidence presented in this report.

Gains on achievement tests. Expressed concretely, the fundamental plan was to give comparable tests of achievement appropriate to each grade level at the beginning and end of the experimental period, and compare the gains of the Typewriter groups with the gains of the corresponding Control groups. Other things being equal, it was obviously desirable to use tests at each grade level which would afford the broadest possible measure of general educational progress appropriate to each grade, as well as measures of specific achievements. Accordingly, our chief reliance has been placed on the New Stanford Achievement Tests for grades three to six, and upon the Gates Reading Tests, Types 1, 2, and 3, for grades one and two. No achievement tests were given in the kindergarten.

Since the investigation was originally planned to go through only one full school year, September 1929 to June 1930, forms 1 and 2 of the Gates tests and forms W and X of the Stanford tests enabled us to secure comparable initial and final measurements. When the grant of a second subvention enabled us to extend the investigation through another school year, the need arose for a third form of the Gates and Stanford tests in order to maintain comparability between the first- and second-year test results. Fortunately, form Y of the Stanford Achievement Test was made available by the publishers; but since only two forms of the Gates tests were available, the form given in September 1929 was repeated in May 1931.

Handwriting quality and rate tests were given to both Experimental and Control pupils in 1929, 1930, and 1931. In addition to the handwriting rate and quality tests, the Typewriter children had tests in speed and accuracy of typing in December 1929, May 1930, and May 1931.

In addition to the tests mentioned above, specially constructed tests of spelling were given in both years, and of vocabulary in the second year. The analysis of the results of these unstandardized tests has not been completed, and cannot be included in this report without inordinately delaying its publication. The results of the special spelling and vocabulary tests are therefore reserved for later study.

Children's writings. The pedagogical values widely, and we believe soundly, attributed to the activity of writing, invest

with considerable importance the sheer quantity of writing done during a given period of time by school children. If we grant that writing has pedagogical values, and that the magnitude of these values is positively correlated with the quantity of writing done, then the influence of the typewriter on the quantity of writing done by children merits the most careful study. To this end the Experimental and Control teachers were asked to assume the heavy burden of preserving all of the writing done by children during the school year of 1929–30. The Experimental teachers assumed this burden for the second year also, 1930–31.

The teachers discharged this onerous task so well that we are now in possession of an appallingly large but priceless collection of elementary school children's writings which might well engage the undivided attention of a large research staff for several years. The collection includes all the writings of about fifteen thousand children (kindergarten to grade six) during one school year, and of about four thousand children during two years. The great expense of analyzing the writings of a full school year for any large number of children has limited us to a simple quantitative analysis of a small fraction of the available materials. After considerable study of the sampling problem, it was decided to take all of the first-year materials from four of the coöperating centers, plus all the second-year writings of children in the same four centers who used the typewriters both years. While this small sampling leaves the great bulk of the children's writings untouched, we are confident that the indications of the sampling would not be greatly altered by doubling the size of the sampling. We consider this type of evidence as coördinate in importance with the test results. The nature and quantity of children's writings under the influence of the classroom typewriter have an evidentiary genuineness and directness that are unique.

Teachers' judgments. For certain questions concerning the educational values of the classroom typewriter, the observations and judgments of the teachers constitute evidence of paramount importance. On such questions as the influence of the typewriter on the interest and attitude of the pupils, on the organization and social atmosphere of the classroom, on the individual child's sense of responsibility and civic habits, on the relation of home activities to school activities, we have found no better evidence than the testimony of the teacher. The same may be said of questions regarding the problems of pedagogy and management connected with the typewriter in the classroom. This is particularly true of the testimony of teachers who have had two full years of experience with the classroom typewriter.

Pupils' testimony. The time is definitely past in American education when school problems and methods are decided without regard to the judgment or preference of the pupils concerned. It is therefore without apology that we offer as a substantial part of this report, the testimony of pupils regarding the classroom typewriter.

Numbers of Pupils and Machines Involved in the Experiment

Participating schools. The expensiveness of a controlled experiment involving several initial and final tests and large numbers of pupils scattered through several grades, and the original availability of the loaned machines for only one year, made it important that only those schools should be invited to participate which were free enough from other commitments to take full advantage of the opportunity. During the spring and summer of 1929, many schools were visited

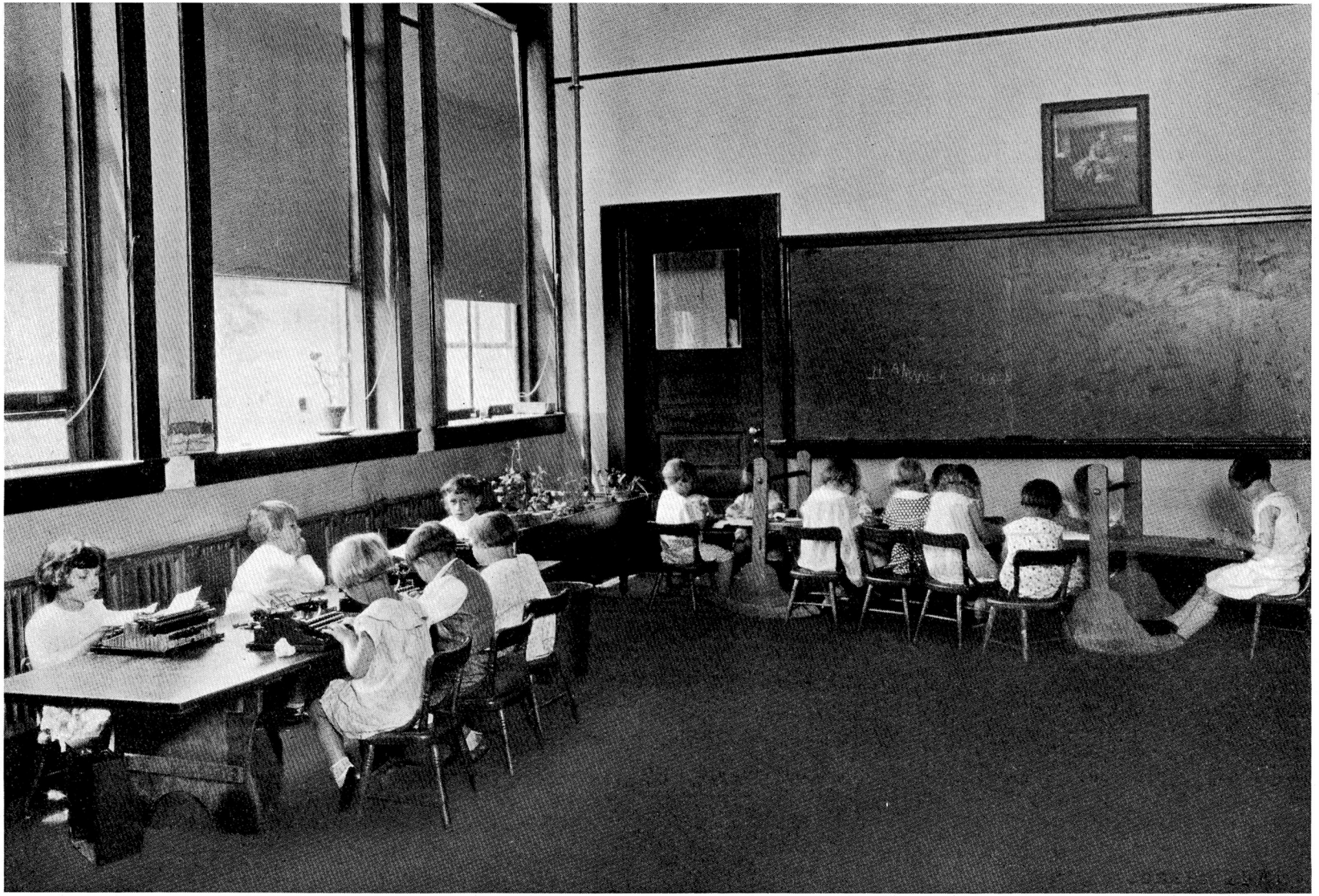

PLATE 2. THE TYPEWRITERS IN A KINDERGARTEN ROOM

One little girl is typewriting the title on a drawing. The many activities that are carried on simultaneously do not interfere with each other. The tots at the machines are as absorbed in writing as the other children are in their activities.

and studied with a view to determining their availability for coöperation in the investigation. In the end identically worded invitations were issued to the superintendents of schools in eight cities and to the headmasters of private schools in four other cities. The invitation emphasized the responsibilities and burdens which would be assumed by the participating schools, as is shown by the following excerpts:

"The guiding question is, 'What are the values (if any) and disadvantages (if any) of the typewriter as a pedagogical instrument in the elementary school?' Since the typewriter in the elementary school will be very intimately associated with the very taproot of education — writing, reading, etc. — this study is concerned with a question of fundamental educational significance. It is in the light of this fact that selected schools will be invited to participate in a serious and carefully planned effort to answer the question stated above.

"We have been able to secure funds sufficient, with generous coöperation from the participating schools, to carry on the experiment for one year. These funds have been contributed by the Typewriter Educational Research Bureau because of the interest of its constituent companies in scientific information regarding the usefulness of the typewriters for educational purposes, and the grant has been made in the form of a trust fund entirely within the legal control of those who will be in charge of the experiment. We are thus in the position of being free to secure valid and impartial scientific evidence on a question of major educational significance. In addition to this grant the four leading manufacturers of portable typewriters have promised to lend for the entire period of the experiment, and to keep in repair, a sufficient number of portable typewriters to make the results of the experiment statistically reliable.

"The participating schools will be responsible for the following items:

"1. They will select experimental and control classes of approximately equal age, intelligence, achievement, and social background, pairing these classes in each school grade.

"2. They will select experimental teachers who have a genuine interest in the research and who can be depended upon to carry on coöperatively and constructively to the end of the experiment.

"3. They will administer the tests scheduled by the investigation for the experimental and control classes. (These tests will be for the most part general educational tests which the schools are already giving or desire to give, such as the Stanford Achievement, handwriting, reading, composition, and similar tests.)

"4. They must agree to coöperate in avoiding publicity.

"5. They must agree to continue the experiment for at least one full school session, *e.g.*, September 1929 to June 1930.

"6. They must agree to save all the writings of both typewriter and control children throughout the duration of the experiment.

"In no case will the school be asked to begin or continue any activity in connection with this experiment which shall, in the judgment of the experimental teacher and principal, militate against the educational aims of the school. For example, the handwriting exercises prescribed by the school, or usually implied by its curriculum, must not be diminished or altered for the sake of using the typewriters."

In spite of the heavy burdens involved, all the schools addressed accepted the invitation so that the investigation began in September 1929 in the public schools of

Albuquerque, New Mexico
Altoona, Pennsylvania
Chicago, Illinois
Elizabeth, New Jersey
Montclair, New Jersey
Pittsburgh, Pennsylvania
Roslyn, New York
Springfield, Massachusetts

and in the following private schools

The Horace Mann School, Teachers College, Columbia University, New York City
The Barnard School for Girls, New York City
Germantown Friends School, Philadelphia, Pennsylvania
Utica Country Day School, New Hartford, New York
University of Chicago Elementary School, Chicago, Illinois

In the eight cities the superintendents designated certain schools to serve as Experi-

mental, and other schools to serve as Control schools.

While the primary consideration in extending the investigation to private schools was to ascertain the general adaptability of the typewriter to various types of schools, it was hoped that sufficiently comparable conditions might be found between some of the private schools to make possible test comparisons. With this hope in mind, the following schools were asked to serve as Control schools, and the headmasters graciously consented:

Scarborough School, Scarborough, New York

Friends Central School, Philadelphia, Pennsylvania

Moorestown Friends School, Moorestown, New Jersey

These three schools, like the other Control schools, coöperated fully during the first year of the experiment, and test data from them are on hand; but a careful study of their curricula, and of the initial test data, made it apparent that fundamental differences between them and the Experimental private schools were so large as to make comparisons of test gains difficult or impossible to interpret. We have therefore omitted test comparisons between Experimental and Control private schools.

For convenience of discussion the cities and schools named above will hereafter be referred to by letter.

TABLE 1

NUMBERS OF SCHOOLS, TEACHERS, AND PUPILS IN THE EXPERIMENT IN SEPTEMBER 1929

The numbers of pupils indicated here represent official enrollment figures for the Experimental and Control classes in September 1929. Some of these pupils dropped out, and some failed to take one or more of the tests, and hence are not represented in the tables and charts presented in succeeding chapters. The numbers of typewriters allotted to the Experimental pupils and teachers in each participating center are shown in the last two columns at the right. Cities A to F are included in the consolidated test comparison groups described in the text. Results from the other cities and schools are presented separately in Chapter X.

	CONTROL			TYPEWRITER				
	SCHOOLS	TEACHERS	PUPILS	SCHOOLS	TEACHERS	PUPILS	MACHINES	
							Pupils	Teachers
City A	1	6	222	1	6	233	91	9
City B	4	44	1647	3	31	1082	288	33
City C	1	19	541	1	10	284	60	11
City D	2	26	1365	1	12	667	186	14
City E	2	24	762	1	9	274	49	12
City F	9	56	2218	13	45	1598	294	56
Subtotal	19	175	6755	20	113	4138	968	135
City G	1	17	597	1	11	433	160	**
City H	1	22	893	1	12	541	145	**
School I	1	12	212	1	14	332	272	19
School J	1	7	206	1	17	405	170	**
School K	1	6	161	1	7	114	40	**
School L				1	3	72	24	**
School M*				1	3	90	60	**
Grand Total	24	239	8824	27	180	6125	1839	154

* In 1930–31 the data for School M were as follows: 1 12 284 160

** The machines allotted to teachers in these cities and schools were kept in the classrooms, available to pupils with the other machines. This was also true of some classes in the other cities.

Numbers of Experimental and Control children and teachers. Table 1 shows the numbers of Experimental and Control teachers, and of Experimental and Control pupils in each of the participating cities and schools, and also the number of machines allotted to each city or school at the beginning of the experiment, September 1929. The magnitude of the investigation can be estimated from the fact that during the first year nearly fifteen thousand children and over four hundred teachers were involved. Of the pupils, 8824 were in the Control groups, and 6125 were in the Experimental groups; of the teachers, 239 were in the Control and 180 in the Experimental groups.

The participation of such large numbers of pupils and teachers in eight public school systems and in five private schools leads us to believe that our Experimental and Control groups may be safely considered as representative of American elementary schools in general. It was hoped that comparable learning conditions would be found in most of the public school systems participating in the experiment, so that the test results could be merged into groups large enough to afford statistically reliable comparisons. This hope was fulfilled, since sufficiently comparable conditions were found to obtain in six of the eight cities to warrant the consolidation of the test returns from them for the Gates Reading and the Stanford Achievement Test comparisons described in Chapters II and III. The six cities (A to F, inclusive), set apart in Table 1 with subtotals, include more than two-thirds of all the pupils in the Typewriter and Control groups from all participating cities and schools.

City G returns could not be included in the six-city public school consolidation because curriculum and other differences between the Typewriter and Control schools were discovered; and in City H so many Typewriter pupils were absent from parts of the initial or final Gates or Stanford tests that the inclusion of the few complete returns in the consolidation was deemed inadvisable. The teachers' judgments and the children's testimony from these cities are, however, included with the returns from all centers, as will be explained in succeeding chapters.

An important consideration in extending the investigation to private schools was to study the administrative aspects and the general adaptability of the typewriter in a wide variety of school situations. For this reason the plans for using the machines, the tests used, and the kinds and amounts of data secured, were materially different in these five schools. For example, in School I, each child in grades two to six had a machine; in Schools J and L, no tests were given in the first or second year, the whole emphasis being on subjectively observing the effects of various ways of using the machines; in School M, the experiment was organized in three distinct units, and the number of machines was greater in the second year than in the first. These variant conditions require separate presentations of the evidence secured from these schools. Summaries of their contributions, and of the results obtained from Cities G and H, will be found in Chapter X.

Pupils' machines. The 6125 Typewriter pupils in all cities and schools began the experiment with a total of 1839 machines, making a ratio of approximately two machines for each seven pupils. At the beginning of the second year, one hundred additional machines were provided for School M, thus making the total number of machines used in the second year by the pupils in all cities about 1950, and by the teachers about 150.

However, the 4138 pupils in Cities A to F, inclusive, began the experiment with less

than 1000 machines, and continued through the two years with this number. Therefore, the ratio of machines to pupils in the consolidated Typewriter group involved in the Gates Reading and Stanford Achievement Test comparisons in Chapters II and III was only one machine for each four children.

Time spent at machines by pupils. It was found impossible to secure exact data on the amount of time spent at the machines by the children. We know that a few children in all grades used the machines considerably less than one hour a week on the average; and that many children, particularly in grades two to six, averaged from four to six hours a week at the machines. These pupils are among the large number who were reported to us by the teachers as coming to school a half hour early in the morning, or staying in at recess periods, or staying after school hours in the afternoon, for the sake of working on their projects at the machines.

The best estimate we can make from the reports of the teachers is that children in the kindergarten and first grade averaged between 50 and 80 minutes a week, and in the remaining grades from 90 to 130 minutes a week. Of course, many pupils, even very young ones, exceeded the average by large margins. The time spent at the machines was distributed in from two to five periods a week, although in some classrooms pupils were allowed to use the machines whenever they were free and willing to do so.

Teachers' machines. While the pupils' machines were delivered at the schools late in August or early in September 1929, the machines allotted to the teachers of the Experimental classes were delivered to them in June 1929, so that during vacation they might familiarize themselves as much as possible with the machines. This was an

TABLE 2

GRADE DISTRIBUTION OF THE TEACHERS AND PUPILS AND MACHINES DESCRIBED IN TABLE 1 ABOVE

	GRADES	CONTROL		TYPEWRITER		
		TEACHERS	PUPILS	TEACHERS	PUPILS	PUPILS' MACHINES
Cities A to F	Kindergarten	19	852	13	542	52
	1	40	1532	25	900	184
	2	28	1099	19	724	180
	3	25	880	15	557	132
	4	22	871	13	477	153
	5	22	837	12	477	156
	6	18	670	9	357	94
	Special	1	14	7	104	17
	Subtotal	175	6755	113	4138	968
Other Cities and Schools	Kindergarten	3	79	4	114	14
	1	11	345	15	411	160
	2	11	341	11	318	155
	3	10	318	11	343	165
	4	11	333	8	265	117
	5	8	314	10	295	142
	6	9	321	8	241	118
	Special	1	18			
	Total	239	8824	180	6125	1839

important provision, because 90 per cent of the Experimental teachers reported that they had never used a typewriter of any sort. In judging the evidence presented in succeeding chapters, the reader should keep in mind these basic conditions of the experiment; namely, that 90 per cent of our Experimental teachers had no contact with the typewriter prior to the beginning of the experiment, and that the Experimental pupils in our major test comparison group had available only one machine for each four pupils.

Grade distributions of Experimental and Control pupils. Table 2 shows the grade distribution of the Experimental and Control children. Except in the kindergarten, the numbers of children are larger in the lower than in the upper grades. In Table 2 we have again set off with subtotals the six cities which furnish our consolidated six-city comparison groups, described below in Chapter II.

Numbers of pupils involved in the second year of the investigation. Since a primary consideration in extending the experiment through a second year was to take advantage of the experience which the Experimental teachers and children had acquired from their first year's contact with the machines, every effort was made to retain all these teachers and pupils in the second-year Experimental classes. Because of promotions, transfers, and administrative complexities, about one-third of the Experimental teachers and pupils in the second year were new to the experiment, but the total number of old and new pupils in the 1930–31 Experimental classes was about the same as the total number in 1929–30. Limited resources made it necessary to eliminate the Control groups from the second-year testing program, thus obliging us to accept provisionally the assumption that the Control results for the first year would give us usable norms for the six cities concerned for the second year.

Experimental Teachers' Manual

We have already mentioned the fact that very few of the Experimental teachers had ever used the typewriter prior to the beginning of the present investigation. Almost none of them had ever used the typewriter as a pedagogical device in the classroom. In order to make the experiment a fair trial of the adaptability of the typewriter to classroom purposes, it was necessary for the teachers to familiarize themselves with the typewriter as a mechanism. With this end in view, typewriters, together with booklets of directions for their operation, were placed in the hands of the Experimental teachers in June 1929, three months before they were to begin the work of introducing the typewriters to the children. It also seemed wise in view of the complexity of the problem of introducing a new writing mechanism into the classroom, that the Experimental teachers should have in mind something definite and concrete, if only provisional, regarding the first steps to be taken in introducing the children to the machines. For this purpose a manual of instruction for the guidance of the Experimental teachers was prepared by Dr. Haefner and placed in the hands of each Experimental teacher at the beginning of the school session in September 1929.

This manual played so important a part in the inauguration and conduct of the investigation that it is reproduced below in full. The pedagogical instructions to the teachers are designedly suggestive rather than directive. The suggestions were based upon observations made during the summer of 1929 in the demonstration school in one of the coöperating centers, in which the typewriters were used informally under the general direction of the supervisor of elementary schools. The samples of children's writings were collected in this summer demonstration school.

A MANUAL FOR THE GUIDANCE OF EXPERIMENTAL TEACHERS IN THE CLASSROOM TYPEWRITER INVESTIGATION

Introduction

This manual is intended to provide you with a set of directions and suggestions for use in the typewriter investigation. It is felt that a standard procedure, wherever it is possible in the work, will make the results from the various rooms more comparable and thus increase the general reliability of the conclusions to which the investigation may lead. However, conditions in different classrooms will vary to a certain extent. Moreover, only a few of the problems that will arise can be foreseen, so that teachers and principals should consider these directions as provisional guides and should feel free to adapt them, within reasonable limits, to their own particular situations.

This manual is divided into four main parts: (1) the general nature and plan of the experiment, (2) the testing program, (3) the use of the typewriter by the child, (4) the keeping of records.

I. The Plan of the Experiment

Background for this experiment. For a number of years psychologists and school people have felt that the rather laborious method of writing by hand might be supplemented by such a mechanical device as the typewriter. It seemed clear to these people that, *a priori*, there were a number of rather obvious advantages of typewriting as compared with ordinary handwriting. Among these were the simplicity of the muscular coördinations required in typewriting, speed, legibility, and the ease of saving compact typed material. In spite of these arguments the schools have been slow to adopt so radical a departure from traditional practice. Isolated institutions have tried the use of machines with small groups of children, and individuals have in some cases provided their children with typewriters.

Although there is a good deal of theory and a small amount of practice in favor of the use of the typewriter with children as young as those in the elementary school, the entire matter has never been put to a careful and thorough test. The present investigation is therefore organized with this comprehensive problem before it: How will the use of the typewriter by the children in the kindergarten through the sixth grade affect the amount and quality of work which the children do in the various school subjects taught in these grades? The rest of this manual will be devoted to a detailed discussion of the plan by which it is proposed to obtain an answer to this question.

The general plan of the study. The investigation as now planned involves four main types of activities: (1) at the beginning, certain tests will be given to the children for the purpose of providing data as to the quality of school work which they have done in the past, (2) the children will be carefully introduced to the typewriter and will be provided with instructions as to the care and use of it in school, (3) the written work of the children, both typewritten and handwritten, will be preserved and analyzed, (4) various tests will be given at intervals throughout the year.

Desirability of avoiding publicity. It is important from the point of view of the final outcome of the investigation that the use of the typewriter by your children be given no undue publicity. The requests for information as to the reasons for the presence of the machines in your room will probably come from two sources: first, from the children and their parents; second, from the newspapers of the community.

As soon as the typewriters have been introduced to the children and have been talked about at home, there may be some inquiries from parents as to the reason for this type of apparatus in the school. It should be pointed out to them that new types of equipment, such as the motion picture machine and the radio, are constantly being adapted for use in the schools. The typewriter is just another form of equipment which the local school administration is interested in putting at the disposal of the children to determine its educational value.

With respect to the second type of publicity, namely, that arising from local newspapers, the teachers can probably avoid it largely by not referring to the use of the typewriters in their rooms as in any way spectacular or "experimental." It will be remembered always that newspapers are usually not interested in the ordinary, or routine type of event. However, if the teachers are requested directly by reporters for a statement concerning the work, they should refer the newspaper people to the office of the principal or superintendent. They should not themselves attempt to discuss the work with reporters.

II. Testing Activity

Types of tests to be given. The tests which are to be given to your pupils will be of two types:

(1) general intelligence tests, (2) subject-matter or achievement tests.

Only one intelligence test will be given to each child. Children in the kindergarten and in grades 1 and 2 will take the Pintner-Cunningham Primary Mental Test, form A. Children in grades 3 to 6 will take the National Intelligence Test, scale A, form 3.

The achievement tests are of four types: (1) in grades 1 and 2 the Gates Primary Reading Tests, types 1, 2, and 3, form 2 will be used, (2) in grade 3 the New Stanford Achievement Test, primary examination, form W will be used, (3) in grades 4 to 6 the New Stanford Achievement Test, advanced examination, form W will be used, (4) in grades 2 to 6 a sample of each child's handwriting will be taken.

Giving the tests. The tests will be given the second or third week after school opens in September. Your principal will inform you as to the exact date. Your principal or supervisor will assist you in giving the tests. If you have not had experience in giving tests, you will be provided with instructions and assistance.

As soon as the tests have been given, they are to be returned to the principal, who will arrange to have them scored. Teachers will not be asked to do any of the scoring.

III. The Use of the Typewriter

A. General Care of Machines

Housing the machines. Each room in which the investigation is being carried on has been provided with a group of typewriters which are part of the regular equipment of the room for the school year. Since typewriters are both bulky and costly, special arrangements have been made in the various rooms for cabinets in which the machines are to be kept when not in use and in which they are to be locked when school closes for the day. These precautions are to prevent injury or loss of machines. No typewriter may be taken from your school building by children or others except on the written authority of the principal.

Placing machines in the storage cabinets. In order that the machines may be most easily handled by the children, the cabinets have been so planned that the typewriters will be placed in them on the edge with the handle toward the front. With a certain amount of supervision at the beginning of the experiment, the children will soon learn the accepted method of removing and returning a machine to the cabinet. Small children should never be allowed to lift or move typewriters, because they might injure themselves as well as the machines.

General care of machines by the children. Since the purpose of the experiment is to determine the value of the typewriter as an instrument of school instruction, it is important that no obstacles be raised to the use of the machines. At the same time, it is imperative that the children understand from the start that serious damage can be done to the typewriters by careless or rough handling.

The children should be shown how to put the cover on the machine securely before it is picked up by the handle. This will involve understanding the device which is on some of the machines for locking the carriage before the cover is put on. In the case of all of the machines the carriage, which moves toward the left as the writing is done, has to be in the middle of the machine before the cover can be put on. On some of the machines there is a little trick which has to be learned of getting the back hinges of the cover properly attached to the base before the front can be pushed down into place. The children should be instructed to try the front of the cover to see that it is locked before they try to lift the machine by the handle on the cover.

Marking the machines. You will be provided with large posters bearing two letters — the letter P for Public and the letter S for School. One of these posters is to be pasted to each side of the typewriter case as a means of identifying the machines which have been assigned to your school. Your principal will supply you with these posters. They should be put on before any use is made of the machines, to prevent confusion with individually owned machines.

Cushions for use with machines. In order to discover whether special seating arrangements are an aid to the use of the typewriter in the classroom, certain classes have been provided with cushions to be placed on the seats when the machines are used. If your room is to use cushions, you will find that cabinet space has been provided for them and they should be stored there when not in use.

Repair of machines. From time to time during the year the typewriters will need repairing and adjusting. It is planned to give the machines regular inspections to insure that they are in good working condition. Sometimes emergency repairs will be needed. To meet this situation a typewriter mechanic is being designated in your city to give you service on short notice. Your principal will know who this person is. You are asked to request the help of this mechanic whenever your typewriters are in need of adjustment.

There are a few matters concerning the care of the machines that will at first seem to call for

expert assistance but which the teacher will soon find that she and the children can adjust. If, for example, the shift key is locked down, the lock at the end of the carriage will not operate and the cover cannot be brought down closely on the machine. If no mark is produced when a key is struck, examine the ribbon lever to see that it does not stand at the position for cutting stencils, in which case the ribbon will be thrown off. If the roller turns freely in either direction, examine the end of the carriage at the left to see whether the small lever controlling the ratchet has been thrown off. These are suggestive of a number of small matters which the teacher can easily learn to adjust by study of the machine and the manual of directions which is supplied by the manufacturer.

B. Introduction of the Children to the Machines

Importance of careful introduction. The use of the typewriter involves a complex set of operations, which the child can learn only by gradual steps. It is of much importance that a good emotional attitude be obtained toward the work from the beginning and be maintained throughout the year. The child should come to think of the use of the machine as an opportunity. No coercion of any sort should be used to obtain practice on the typewriters.

There are two general factors which will operate to make the beginning of the work attractive and successful from the point of view of the child. First, a definite effort should be made to arouse an interest in the machines and a desire to use them before the children are actually permitted to try them. Second, the teacher should prepare herself by use and study of the machine to give the children a simple demonstration and explanation of the large operations which are needed to get the machine ready for writing.

Arousing the interest of the children. It is not the intention to place the typewriters in the hands of the pupils until after the testing has been done, i.e. until after the second or third week of school. However, previous to this time the teacher should make reference to the fact that the machines are in the room and that the children will have an opportunity to use them. If there are children in the room who have already used a typewriter at home or elsewhere, they may be permitted to relate some of their experiences to the others. An intermediate grade teacher typed a page of a class newspaper which the children were preparing. When they saw how much space was saved, they clamored to be taught how to use the typewriter. The suggestion that by the use of the machine one can write his own name in print will be sufficient stimulus to many younger children to wish to learn to operate the typewriter.

Demonstration by the teacher of the use of typewriter. The teacher should make very careful preparation for this phase of the introductory work. It is suggested that the teacher plan this first presentation as she would any other important and novel type of school work. The steps to be followed should be clearly in mind before the demonstration is made for the children.

If the enrollment of the room is large, it may be advantageous to take a third or half of the children at a time. They may be asked to gather around the teacher's desk so that they can see the operations at close range. After the first group has been shown some of the fundamental operations, they may be permitted to practice what they have seen while the teacher instructs another group. Those who are practicing may work in groups of two to five, depending on the ratio of machines to children. One child may go through the operations while the others watch him and criticize his procedure.

Operations needed by younger children. With children in the kindergarten and the first grade, only the minimum number of movements needed for writing on the machine should be presented. The following activities will enable most small children to use the machine:

1. After the typewriter has been placed on the desk, the child should be taught how to remove the cover.
2. The method of inserting the paper should next be shown. It is not wise to try to teach the young child the method of straightening the paper in case it goes in crooked. Let him take it out and put it in again.
3. Show the child that in general the right hand is used to strike the keys on the right side of the machine and the left hand for those on the left side.
4. Show the child how to use the spacer with his thumb.
5. Demonstrate the method of striking the keys with a quick touch rather than with hard pressure.
6. Explain the method of line spacing by the use of the knob at the right end of the carriage.
7. When the bell rings at the end of the line, show how to push the carriage back.
8. The use of the shift key may be introduced after the child has learned the location of the letters.

Operations needed by older children. With older children (those above the second grade) the preceding steps may be expanded to some extent. The following would represent the series of opera-

PLATE 3. THE TYPEWRITERS IN A FIRST-GRADE CLASS

Typewriters are used by four of the children while the others are having an oral reading lesson.

tions which should be demonstrated for children of this age.

1. The operation of removing the cover from the machine and putting it in a designated place where it may rest safely until put back on the machine, should first be shown.
2. If the machine has a locking device on the carriage, the method of release should be shown.
3. The insertion of the paper should next be demonstrated.
4. The use of the devices for straightening the paper may be delayed for a time if they seem to introduce too many new operations at one time.
5. The method of adjusting the margin will need to be shown unless it seems simpler to set the margin on the machine and ask the child to put his paper in even with the edge of the roller.
6. Show the child that in general the right hand is used to strike the keys on the right side of the machine and the left hand those on the left side.
7. Show the child how to use the spacer with his thumb.
8. Demonstrate the method of striking the keys with a quick touch rather than with hard pressure.
9. Explain the method of line spacing at first by the use of the knob at the right end of the carriage; later with the spacer at the left of the carriage.
10. When the bell rings at the end of the line, show how to push the carriage back.
11. The use of the shift key will enable the child to make capital letters.
12. The operation of locking the machine and replacing the cover will need to be clearly demonstrated.

Some teachers have found it of advantage to spend a little time practicing on these various simple acts before much real writing is attempted. Thus a child would learn to insert paper correctly by doing it a number of times. The use of the spacer and the return of the carriage at the end of the line can be practiced together. Some teachers have given drill on locating letters on the keyboard before actual writing is begun.

Use of wall chart. As an aid to the understanding of the keyboard, each room has been supplied with a large wall chart showing the arrangement of the letters on the keyboard. With children who already know the letters, the use of this chart has been found valuable as an aid in showing the general location of the different characters on the keyboard. The charts are not supplied with the thought that any arbitrary system of using the machine is to be applied in the teaching.

Supervision by the teacher during the early stages of learning the machine. The teacher has by no means finished her work in the matter of instruction when she has given the first demonstration on the use of the typewriter. Whenever the machines are in use in the room and the teacher is disengaged from other work, she should give the child such assistance and encouragement as will aid him in gaining the feeling of success in this new undertaking. The first few weeks with the machine will undoubtedly be crucial ones with a considerable number of children. The teacher should, therefore, be prepared to give more help during the early part of the learning than will be needed later. After the child has gained a moderate amount of skill in the use of the typewriter and has come to see some of its possibilities, he is likely to be carried along by the project somewhat more easily.

Previous experience of children with the typewriter. Before the children are actually allowed to use the machines it is suggested that each teacher find out the names of the children who: (1) have had no contact with a typewriter in any way, (2) have "played" with a machine without doing much writing on it, (3) have done some writing on it. These data will be helpful in checking up on the time required for children to learn the use of the machine.

Organization of a time schedule for the use of the machines. After the children have been shown the fundamental operations, a schedule for the use of the machines will need to be worked out. Times at which machines can be used by anyone who wishes should be designated, such as before and after school, at recess, at free periods. The use of the machines during class hours will have to be determined by the teacher, in view of the needs of the entire group. The typewriter should never become a distracting factor in a classroom. However, the novelty of the machines in the room, like any unusual piece of equipment, should not be mistaken for a disturbing element. Most of the children will get used to the sound of the machines in a relatively short time.

In connection with the plans for practice on the machines, a group scheme may be worked out for the care of the typewriters. For example, a committee of two or more children may be appointed to serve for a week to get out the machines and put them away. Gradually, as certain children show special aptitude in the use and care of the typewriters, they may be appointed for a week or more at a time to help those who have difficulties in operating the machines. The continuance of such appointments may well be made contingent upon the maintenance of the

jmnbvgftrewasz

ROL

caol

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iuytresxc jghbnvcdertyuiooplkj

678906

hhgftryuio

FIGURE 1.

i love little baby
she is a little baby
ilove baby

baby

love

cat

cow

FIGURE 2.

raymond La

Raymond Lavoy

200 King Street.

Pittsburgh Penna.

FIGURE 3.

Dear

DearBrownie. ''He lpful.Tha
Thank you for thenicebook

FIGURE 4.

good quality of work on the machines of those children who are designated to help the others.

C. *The Typewriter as an Educational Instrument*

Uses of the typewriter by younger children. After the younger children have been given an informal introduction to the machine it seems valuable to allow a period of time during which the child is permitted to "play" with the machine. He sits at the typewriter, hits the keys, moves the carriage, turns the roller, uses the spacer. As soon as he can insert paper, he is ready to make a line of characters. Fig. 1 is a facsimile of a piece of work done by a pre-primary child during the first few days of his use of the machine which illustrates the first effort of a young child.

When the child knows the spelling of some short words, he may be shown how to arrange the letters in order, so that a word is produced. Fig. 2 is a facsimile of a piece of writing done by another pre-primary child in an early stage of the use of the machine.

When the child has learned the use of the spacer, a slip of paper may then be given him containing his name, his age, and the name of the school; he may be encouraged to copy this on the typewriter. Fig. 3 is a facsimile of what one pre-primary child did with this assignment.

Later activities for younger children. After the child has successfully completed the assignment of writing his name and address, he may be given short sentences to copy. One primary teacher then had the children copy two-sentence compositions to be used in making a baby book.

Children in the second grade may write a short letter, of which Fig. 4 is an illustration.

Children in the second grade typed labels to be used on a chart of animal workers which was being made. Sentences such as the following were typed: "We get milk from cows." "We use the cow's skin for leather."

Fig. 5 is illustrative of the type of work which can be done by young children after a short period of contact with the typewriter. It is a facsimile of a copy made by a third grade child at the end of the third week with the machine.

Initial assignments for upper elementary school children. In order that some of the early written work may be used for later comparative purposes, it is desired that a few pieces of typing be the same for all the rooms in which the machines are being used. It is therefore suggested that each child who can write, *i.e.* those from the second to the sixth grade, be first given the assignment of writing his own name, his address, the name of the school, the grade, the name of the teacher, and the date. The teacher should supply a model typed form to guide the children in this assignment. As soon as the child has succeeded in doing this assignment with a fair degree of skill, he should be permitted to take a copy of it home to show his parents. The teacher should supervise the child's use of the machine rather closely until he has satisfactorily completed this assignment.

It is suggested that the second assignment for upper grade children be the writing of a letter by the child to his parents. The content of this letter may deal with any phase of school work which the child is interested in writing about. Fig. 6 is a facsimile of a letter written by a fourth grade child in the course of three weeks' use of the machine.

Class projects by the help of the typewriter. Typing projects which are undertaken by an entire class or by a group in a class can be of very great educational value, not only in learning subject-matter but in developing effective attitudes and habits of constructive coöperation. A group of children working on a geography or a history notebook which will require an extended period of time for completion may be permitted to announce its progress from day to day by a typewritten statement for the bulletin board. A class notebook in such a subject as history, to which each child makes a weekly or bi-weekly contribution will be more attractive to the children if part or all of the written matter is typed by them.

A fifth grade newspaper project. As illustrative of the educational value of the typewriter with intermediate grade children, a fifth grade teacher gave the following description of a newspaper project:

> "The decision of the fifth grade to have a class newspaper required careful planning for its many departments. After much work a paper of eight pages was produced. The stories, poems, notices, etc., were pasted on sheets of oak tag, one sheet being inside the other. When the items were read to the class, the newspaper was bulky and clumsy for the pupil authors to hold.
>
> "When the typewriters arrived, the class was preparing the copy for the second issue of the newspaper. The teacher made a typewritten copy of the stories which were on the first page of the issue. When the class saw this and noticed how much space could be saved and how much better the size of their paper would be, with one accord they clamored to be taught how to use the typewriter at once."

Other uses of the typewriter in the intermediate grades. The following are various types of

Lydia Elia Singing - Time

I wake in the morning early

And always the very first thing

Ipoke out my head and I sit up in bed

And I sing and I sing and Ising.

FIGURE 5.

July I0) I929

IIOGreen St.

Dear Mother ,

Inschool we are styuding about ships. Thursday we dr drewwpictures of the primitives. Wedrew pictures of the vikings,too. I like to come to summer school becausewe have music every morning. Ialso like to come t tosummer school because wehave many games,too.

I sometimes get 70- 80- 90-andI00.

Your daughter
Dorothy

FIGURE 6.

school activities in connection with which teachers have found the typewriter of help.

1. Copying stories, poems, etc. for a class year book.
2. Writing stories, etc. for an individual booklet.
3. Writing letters.
4. Making reports of books read.
5. Making a list of books which the class would recommend to next year's class.
6. Writing labels for the bulletin board.
7. Listing the spelling words which need special study.
8. Making bibliography cards for the classroom file.
9. Writing compositions in connection with literature, geography, history, and citizenship.
10. Keeping a loose-leaf notebook in connection with such subjects as geography, history, civics, nature study, health, safety, etc.

Relation of typewriting to handwriting. It is not the intention that the use of the typewriter should interfere with the development of good handwriting in any grade. Some teachers have used the typewriter as a reward for the achievement by pupils of a certain quality of handwriting and have limited the use of the machines until this goal has been reached. The following account given by a fourth grade teacher illustrates a method of meeting the problem.

When the typewriters were introduced into a fourth grade, the teacher feared that the penmanship might suffer and therefore used the following plan in her room:

> "Each child made a specimen of his handwriting and compared it with the specimen of three months before. Most of them had made a gain both in quality and speed. Some had gained so much that they had reached the standard for their grade as indicated on the standard scale. The typewriters had arrived the day before and everyone was most eager to have the privilege of using them. It seemed fair to the class, after discussion, that those who had reached the grade standard should be allowed to use the machines first, and become the charter members of the Typewriter Class. The poorer writers were eligible to membership in the class as soon as the quality and speed of their penmanship reached the standard. The members of the Typewriter Class were required to keep their writing up to the grade standard in their spelling, composition, etc. or be suspended from the class. The interest and enthusiasm was so great that the teacher discovered in the sixth month of the year that the class was doing as good writing as she usually found at the end of the year."

This plan seems a good one, so long as it is used reasonably, and not too rigorously. For example, a child who for any reason is excessively retarded in handwriting should not on that account be denied the privilege of using the typewriter. Indeed, the use of the typewriter may be the most efficacious way of improving his handwriting.

IV. Preservation of Written Work

Purpose of saving written work. In order to provide data for judging the effect of the typewriter on the school work of the children, teachers are asked to preserve all of the written work of each child for the year, *whether done on the typewriter or by hand*, with the exception [1] of arithmetic. If arithmetic is used as the basis of a project or if a regular arithmetic notebook is kept, then this work should also be preserved. Of course, *no effort is to be made to do written work merely to have something to save. All that is wanted is the written work which is done in connection with the regular activities of the class.*

The preservation of all the written work of a class for a year will have incidental values which are alone great enough to justify all the care and time which the teacher can devote to this phase of the experiment. So far as is known, no one has ever studied the quantity and variety of writing that school children do in a year. The collection should be as complete as possible. Hence, if your children do any writing at home, *e.g.* letters to relatives, you should get copies, if possible, or make notes on the quantity, nature, and quality of such writing.

Types of work which should be saved. The section on the use of the machine has suggested some of the lines of work which may profitably be undertaken. In the lower grades *even the child's very first attempts to use the machine should be kept*, as well as his later efforts to write his name, or copy short sentences or paragraphs from the board or from a book. In the intermediate grades the written work will be longer and will often deal with phases of geography, history, literature, and citizenship. Spelling papers should be saved wherever the work is either handwritten or typed. Notebooks of written work in any subject, whether kept for a month or a term, should be included in the collection. Any of the group projects which involve the preparation of a booklet or a small newspaper should be included in the work which is preserved.

[1] This exception was removed about six weeks after the experiment began, as explained elsewhere in this chapter.

If the problem arises of children wishing to take home written work to show to parents, it is suggested that one of two methods be used in meeting the situation. If the material is brief, the child will probably be glad to use the machine to make an extra copy to take home. If the material is longer, the child may occasionally be permitted to take it home on condition that he return it after the family has seen it. In the upper grades children who are especially skillful in the use of the machines and who know in advance that they want to take specific pieces of work home, may be permitted to experiment with carbon paper.

Method of preserving written work. For the purpose of making the preservation of the written work as easy and as systematic a matter for the teacher as possible, the following supplies are being provided for each room: a dater, an ink pad, a letter size folder for each child, a cardboard cabinet to keep the folders in, and half size typewriting paper. At the beginning of the year, the teacher is asked to fill in the data called for on the top of the folder. This will be done for each child. Each piece of work is to be dated in the upper right-hand corner of the page with the day on which it is done. Under the date the teacher is asked to place the approximate time in minutes which the child devoted to the paper. The paper will then be filed in the child's individual folder. Thus, each child's dated papers will be together in a separate folder. The set of folders for the room can be kept in the cardboard cabinet.

In most rooms a good deal of the dating and filing of the written work can perhaps be done by the children themselves. At the end of each month or at such times as a child's folder becomes too full for convenient handling, the papers may be removed and bound together with rubber bands or cord. Care should be taken that each child's material is kept together, and not mixed with the writings of other children.

The preservation of this written material is considered of basic importance to the success of the investigation and it is therefore hoped that the teachers in whose rooms the machines are being used will carry out the above suggestions with as much care as possible.

The manual reproduced above was placed in the hands of the Experimental teachers early in September 1929. It will be noticed that the opening sentence of Section 4, page 17 above, specifically excepts arithmetic from the written work that was to be saved. Arithmetic was excepted because it did not occur to any of us that the typewriter would have any significant influence on number work and because we wished to lighten the burdens of the collaborating teachers as much as possible. By the middle of October, however, so many of the teachers reported that their children were using the typewriters in number work that all Experimental and Control teachers were soon after directed to save all written work of whatever sort, including arithmetic. This circumstance will be remembered when we come to the indications of the Stanford Achievement Test results regarding the influence of the typewriter on tested achievement in arithmetic.

Directions to Control Teachers

The directions to the Control teachers were very simple, being confined to the directions for giving tests and directions for preserving the written work of the Control children. Through the coöperation of the superintendents and principals, the Control teachers were reminded several times during the course of the experiment of the need for care in preserving all the written materials of the Control children. The following excerpt from a letter dated February 1, 1930, which was sent to all Experimental and Control teachers, will illustrate the nature of our efforts to make the collections of written materials complete for both Experimental and Control schools.

"Every teacher will be asked near the end of the session to report to the administration on the manner in which this task has been fulfilled, indicating just what procedure was followed in making the collection, how and when the papers were dated and put in the folders each week, and expressing a judgment as to how complete the collection has been, and in what types of written work the collection is least complete."

Second Year Manual for Experimental Teachers

As soon as it became apparent in the summer of 1930 that the experiment would be continued a second year, a second manual of directions was prepared by Dr. Haefner for the Experimental teachers. The manual is too long to be reproduced in full, but the first few pages will suffice to indicate the plan of the experiment for the second year.

Classroom Typewriter Investigation

A MANUAL FOR THE GUIDANCE OF EXPERIMENTAL TEACHERS 1930–31

Introductory Statement

A year ago teachers in a number of cities were asked to join in an effort to examine by scientific methods the claims of a new instrument — the portable typewriter — for admission into the classroom of the elementary school. These teachers were provided with certain materials, such as tests and filing equipment, which were intended to facilitate an exact and systematic study of this new educational device. In addition they were given some general suggestions based on the broad principles of psychology and teaching, as to how the typewriter might most profitably be used with children in the kindergarten through the sixth grade. In the main, however, the way was largely left open to them to try out various promising plans for using the machines and to adjust these to the peculiarities of the situation in their several rooms.

The success which has characterized the work of the first year with the machines has been due, therefore, in no small degree to the intelligence and resourcefulness of this body of teachers, administrators, and children who have participated in the investigation. Provided with only very general guidance, they have shown an understanding of the numerous problems involved, an ingenuity in solving them, and an enthusiasm to arrive at the truth, that have been a source of the utmost gratification to those in general charge of the work. It is this spirit which has been displayed so generally during the past year by the school people in the various centers that provides the promise for even more valuable experimental data during the second year.

The analysis which has been thus far made of the results of the first year's work with the machines justifies a very optimistic view of the future use of typewriters in the elementary school. It is still, of course, too early to attempt to draw final conclusions as to the various specific effects produced by the typewriters on the learning of younger children. However, a large number of the outcomes of the first year's work are so suggestive and so promising that further study of them seems of paramount importance in finally appraising the value of the machine. It is with this thought in mind, of revealing fully the very rich possibilities that seem to inhere in the use of the typewriter, that the work of the second year is undertaken.

The remainder of this manual will be devoted to two types of discussions: (1) the general plan for the conduct of the investigation during the second year; (2) a statement concerning some of the broader results of the first year's work, as well as concrete suggestions concerning specific phases of the work.

I. Plans for the Second Year's Work

General Point of View

General effect of two years' use of typewriters. There are two main purposes which underlie the plans for the second year of work with the machines. In the first place, it seems highly desirable to obtain a measure of the effect on the various school activities of two years' use of typewriters. It seems very reasonable to expect that a number of the important values of the machines would not appear with one year of use. This would be true for several reasons. A certain part of the time and effort of the children was devoted during the first year to developing motor habits needed for successfully operating the machines. Many of the children will begin the second year with a fair degree of practical proficiency in the use of the typewriter. They will understand the purpose and use of many of the special devices. They will remember the types of activities which they were able to undertake with the help of the machines.

Again, the teachers who used the machines last year will begin the second year with a fund of invaluable experience. They will be able to anticipate to some extent the various teaching problems which arose last year. They will be better prepared to adjust the use of the machines to other important classroom activities.

With this fund of pupil- and teacher-experience to begin with, an effort will be made to discover the effects of the second year on the regular school work. How, for example, is the quantity and quality of written work influenced by two years of use of the machines by the same chil-

dren? How does an additional year's use of the typewriter affect spelling, reading, and handwriting? Will the children be interested in the machines during the second year?

Special problems which need study during a second year. The second purpose for continuing the investigation is to obtain further data concerning a number of detailed learning, teaching, and administrative problems which arise in connection with the classroom use of typewriters. It is important to know, for example, the typical difficulties met by children at each grade level in learning the use of the machine. What are the specific problems which confront kindergarten children, first grade children, etc.?

The best method for teaching the use of the machine to children of varying ages will, of course, have to be determined in the end by the nature of the learning difficulties which arise. Later in this manual some space is devoted to the experiences which teachers had last year with the problem of introducing children to the machines. Much careful observation will need to be made during the coming year by all the teachers who use the machines to the end that a simple, effective plan for teaching the use of the machine is developed.

The successful orientation of the typewriter in the general organization of the classroom raises numerous problems of primary importance. Can the machines be used to better advantage on the children's desks than on the tables or desks at the side or back of the room? How can the program of activities be arranged to permit the use of the machines without interfering with other important activities?

These various specific problems are raised in order that all teachers be alert to them and search for the best solution possible for them. Individual teachers will be asked to coöperate in obtaining detailed information concerning a number of them. Plans for this part of the work will be discussed directly with the various teachers and principals involved.

General plan of organization. The investigation is being carried on the second year in the same schools, with the same teachers, and in so far as possible, with the same children. In most of the schools the sixth grade groups pass on to some other buildings and will not be continued in the investigation. In each room there will be a certain number of children who did not use the machines last year. They should use the machines and take the tests given during the year, as do the other children. Their tests should be clipped together and marked "New." Their folders of written material should be labeled in the same way.

In general the number of machines in each room will remain the same as last year. In a few classes the numbers of machines have been increased or decreased and the teachers concerned have been so informed.

Testing during the Second Year

(The directions for the testing program are omitted here, since they are routine in nature, and the tests used during the second year are described in Chapter III.)

Collections of Written Material

Completeness of collections. The files of work which were kept last year are proving of the highest value in determining the effects of the use of the machines. It seems very desirable, therefore, that this part of the work be continued with as much completeness as possible during the second year. In so far as possible all the written material, done either by hand or on the machines, should be saved for each child.

General classification scheme. The categories which were developed last spring for use in classifying the first year's collection have proved to be generally satisfactory. Most of the teachers were able to group the larger part of their material under them, and to do so without too much variation from paper to paper. This scheme will be used during the coming year. (The outline of the classification scheme is reproduced in Chapter IV, page 57, and hence is omitted here.)

Equipment for filing written material. It is desirable to lighten so far as possible the labor involved in caring for this written material. In order to facilitate filing and classification, a two-pocket folder has been provided for each child. The front division has been labeled "original" and the back "copied." This folder makes possible the grouping of the material into the two large divisions as it accumulates.

Each teacher has been provided with two rubber stamps: one labeled ORIGINAL____, the other COPIED____. The line after the word is intended for the letter in the classification which describes the piece of work. Thus, an original story would be stamped ORIGINAL____ and S written on the line; a copied word list would be stamped COPIED____ and W written on the line.

Each piece of material should be dated, following the practice used last year.

If the material is classified as it accumulates, or at least at fairly frequent intervals, one of the most time-consuming phases of the work will be completed before the end of the year.

Removal of material during the year. In order to avoid the storage problem in the various rooms which arose last year, arrangements will be made to remove the material from time to time. This will be worked out with individual schools. Any school which prefers to retain its material until the end of the year will of course be free to do so.

Miscellaneous Matters

Servicing of machines. All machines have been put into first class condition during the summer. All have been reëquipped with two-color ribbons. Inspections of the machines will be made at regular intervals, to relieve the teacher as much as possible and make small needed adjustments before they become troublesome.

Publicity concerning the use of the machines in the schools. The policy of keeping discussion of the investigation out of the public press will be continued during the second year. The teachers and administrative offices handled this difficult phase of the work in an excellent manner during the first year. Their success contributed in no small degree to maintaining the scientific atmosphere which needs to surround an investigation of this type. As was the practice last year, teachers should give out no information concerning the investigation, but should refer all inquiries to an administrative officer.

The following memorandum, sent to all Experimental teachers in October 1930, indirectly emphasizes the informal method by which the children were taught to operate the machines at the beginning of the experiment, and directly emphasizes the minimal character of the typing instruction which the Experimental teachers were requested to give their children during the second year. This memorandum did not, of course, apply to those teachers who were experimenting with the teaching of touch typing. These experiments are mentioned in Chapter X; while not conclusive, they suggest the need for further research in this interesting aspect of the classroom typewriter.

Improvement in Children's Use of Machines

1. *Point of view.* During the first year of the investigation, it was deemed important to give more attention to *what* the child could do with the help of the machines and less to *how* he did it. The varied and voluminous collections of written material which were produced during the first year are evidence of the soundness of the assumption that elementary school children could make excellent use of the typewriters. Even during the first year, however, many teachers became conscious of the problem of guiding more closely the method used by the children in operating the machines. A considerable number of teachers, in fact, paid rather close attention to this part of the work and developed a more systematic mode of handling the machines than the child, by his own efforts, could ordinarily discover.

During the second year, it is desired that all teachers give as much thought to this problem as they possibly can. To this end, each teacher was asked recently to check for a week a list of difficulties which children commonly meet in operating the machines. It was hoped that this analysis would make it easier for each teacher to detect and correct individual instances of these difficulties which were likely to become chronic.

2. *A minimum teaching program.* Observation of a good many children leads to the conclusion that a rather small number of ineffective uses of the machines account for a large percentage of all the difficulties. It is believed that elimination of these would tone up very markedly the skill with which the children operate them. It is therefore proposed that, in all classes from the second grade through the sixth, the teacher try to get the following minimum requirements carried out:

1. Use of both hands on the keyboard, the right hand kept constantly on the right side of the board and the left hand on the left side.
2. Use of the thumb of the right hand on the spacer.
3. Use of the device on the left-hand side of the carriage with the left hand, for spacing between lines.
4. Use of the margin stops at the back of the carriage, to insure an even margin on each side of the paper.

3. *Feasibility of the program.* This program seems attainable in the course of the year with most children in the second grade and above. In fact, individual children have been observed in every room from the kindergarten through the sixth grade who carry out habitually one or more of these four points. It is not urged, however, that the program be carried out rigidly in the kindergarten and first grade during the first half of the year, since the children in those

grades are engaged during that period in achieving a gross mechanical adjustment to the machine.

This program does not carry with it any requirement as to exact fingering of the keyboard. It is not yet clear that the amount of time needed, even by children in the fourth, fifth, and sixth grades, to learn this is justified. There is, at the same time, a certain amount of danger of formalizing the use of the machine, thus reducing the child's interest in it as an instrument of flexible expression. There is no objection, of course, to giving guidance in exact fingering to such children as show a promising interest in typing skill.

4. *Carrying out the program.* The first thing the teacher should do is to make a survey of the class, to ascertain the extent of the problem. This can best be done by rather close observation of individual children. If it is found that most of the class use the thumb on the spacer, it may only be necessary to call this point to the attention of a few individuals. If few in the class use the thumb on the spacer, the reason for the desirability of using it should be explained. In a similar way the other points should be checked up on. In the case of the margin stops, some assistance may be needed by individuals in learning this adjustment.

After the four points have been gradually presented, it may help to keep them in mind if they are put on the board and occasionally referred to. Some teachers have found it possible to delegate a few of the children who have developed good habits in using the machine to check up on the others. One skillful second grade teacher puts a heading such as this on the board: "The Following Children Use the Thumb on the Spacer." As the children earn the right, their names are written in colored chalk under the heading. In a similar way the other skills are encouraged.

CHAPTER II

ACHIEVEMENT TEST RESULTS: FIRST YEAR

Comparative Gains of Typewriter and Control Groups

Introduction

In this chapter we shall compare the test gains made during the first year of the investigation by 2383 children in Typewriter classes and by 3738 children in Control classes. These two groups include all the children who took the intelligence test and the initial and final Gates Reading or Stanford Achievement tests in the six cities in which comparable Experimental and Control groups were found. Table 1 (see above, page 6) shows that the total number of Experimental and Control children in these six cities is over 10,000, which is more than two-thirds of the total number of Experimental and Control children in all participating centers. In view of the large numbers of transfers that normally occur through a school year, and the heavy toll which normal absences and tardinesses of children entail when several tests taken a year apart must be matched for the same individuals, it seems fortunate to us that our study of comparative gains can be based on no fewer than six thousand out of a possible ten thousand-odd cases that were in the Experimental and Control groups in these six cities at the beginning of the investigation in September 1929.

Equality of Typewriter and Control Groups

Given a sufficient number of cases to insure statistical reliability, the essential condition for attributing any differences between the Experimental and Control groups to the influence of the typewriters is that all other conditions affecting learning be known to be equal and normal for the two groups, or that proper allowances be made if any inequalities or irregularities exist. We shall now present the data which lead us to believe that the major learning conditions were approximately equal for the Typewriter and Control groups.

Teachers. Among the important factors that influence the learning of children in the elementary school are the training, experience, and ability of the teachers. In accepting the invitation to participate in the experiment, the superintendents agreed to select schools and teachers for the Experimental and Control groups in such a way that the opportunities of the children would be as nearly equal and normal as possible. The superintendents and supervisors gave assurances during the course of the year that the groups of Typewriter and Control teachers which they had selected were closely equal in training, experience, and ability.

In order to check the matter as objectively as possible, ratings on both Experimental and Control teachers were obtained from the same supervisor in each city. The items rated included personal fitness, professional interest, coöperation, discipline, preparation of day's work, teaching skill, results of teaching, schoolroom hygiene, and care of school property. These items were rated on a five-step scale, one being the highest and five the lowest rating. Ratings were secured on 162 of the 175 Control teachers, and on 102 of the 113

Experimental teachers. The ratings on all ten items were averaged for each teacher in the Experimental and Control groups. The average ratings of the Experimental and Control groups of teachers were 1.47 and 1.89, respectively. The significance of this difference in favor of the Experimental group will be indicated later in this chapter (page 29 ff.).

Data were also secured on the teaching experience, local tenure, college training, and attendance at summer schools, of the Experimental and Control teachers. These data are summarized in Table 3 and show

TABLE 3

TRAINING AND TEACHING EXPERIENCE OF TYPEWRITER AND CONTROL TEACHERS WHO WERE IN THE EXPERIMENT DURING THE FIRST YEAR, 1929–30, IN THE SIX CITIES INVOLVED IN THE GATES AND STANFORD ACHIEVEMENT TEST COMPARISONS IN CHAPTERS II AND III

The table represents all teachers for whom indicated types of data were available.

	Control Teachers		Experimental Teachers	
	Mean	Sigma	Mean	Sigma
Years of teaching experience	15.8	11.2	14.3	10.2
Years in school system	11.9	9.9	11.1	9.8
Semesters in college or normal school	4.7	1.4	4.6	1.4
Number of sessions in summer school	1.75	1.7	1.7	1.5
Number of teachers for whom data were available	166		111	
Supervisors' ratings	1.89	0.95	1.47	0.77
Number of teachers rated	162		102	

close equality of the Experimental and Control teaching groups in all four respects. On the average the Experimental teachers have had slightly shorter experience and slightly shorter tenure in the local school system, they have attended college a fraction of a semester less than the Control teachers, and they are slightly behind the Control teachers in number of summer school sessions attended. Our conclusion is that the Experimental and Control teaching groups are very nearly average groups of teachers. The supervisors' ratings favor the Experimental group by a considerable margin, and the experience, tenure, and training data favor slightly the Control group.

Examination of Table 1 (page 6) will show that the teacher-pupil ratio was about equal for the Experimental and Control groups in the six cities with which we are here concerned, that is, about 37 and 39 pupils per teacher, respectively.

Curriculum opportunity. The curriculum opportunities of the Typewriter and Control children are considered equal, because in each city both groups attended public schools which operated under a city-wide curriculum and under the jurisdiction of the same superintendent and supervisors. Moreover, the curricula in all six cities were so similar that the consolidation of classes from the six cities can hardly favor one group as against the other.

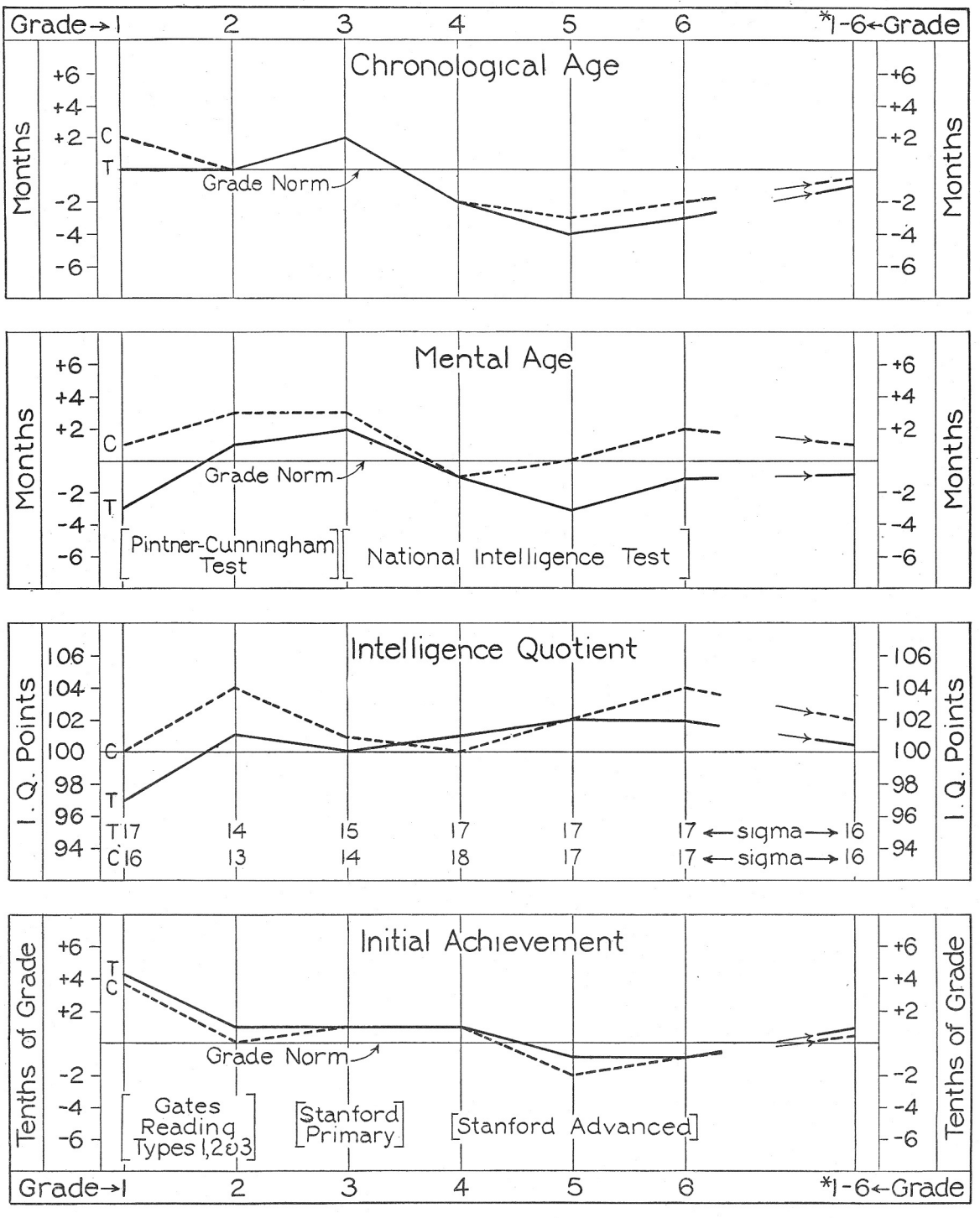
Social and racial background of the Experimental and Control pupils. In each city the superintendents designated the Experimental and Control schools with a view to maintaining equality in all significant respects, including the social and racial background of the pupils. Our observations

throughout the course of the investigation lead us to believe that the 4100 children in the 20 Experimental schools and the 6700 children in the 19 Control schools, as groups, represent equally well the social and racial constitution of the six cities. Of these two groups of children only 2383 Experimental and 3738 Control had complete initial and final tests. If we make the reasonable assumption that these smaller groups represent the larger groups selected for us by the superintendents, the data which we are now about to present on chronological age, mental age, intelligence quotient, and initial achievement of the smaller groups show that the superintendents succeeded quite well in securing equality in the most important educational respects.

Intelligence and initial achievement of Experimental and Control pupils. Chart 1 summarizes and displays graphically the data which we have collected on chronological age, mental age, intelligence quotients, and initial achievement of the 2383 Experimental children and 3738 Control children in grades one to six that had complete initial and final standardized achievement tests. The chart shows the average status of the Control and of the Typewriter group in each school grade. The chronological age and mental age averages for all grades are plotted as deviations from the Stanford norms in terms of months, and the achievement test averages are plotted as deviations in terms of tenths of a grade from the norms given in the Gates and Stanford test manuals. The intelligence quotient averages are plotted against the I.Q. norm of 100, and the deviations are plotted in terms of I.Q. points. The mental age and intelligence quotient averages are based on results of the Pintner-Cunningham test for grades one and two, and the National Intelligence test for grades three to six, inclusive. The initial achievement averages are based on the Gates Reading Tests, Types 1, 2, and 3, for grades one and two, and on the Stanford Achievement tests, primary and advanced, for grades three to six, inclusive. The chart is easy to read if it is remembered that the grade norms for the six grades have been placed arbitrarily on a straight horizontal line.

The general indications of the chart are clear at a glance. The average chronological age is the same for the Experimental and Control groups in all grades except the fifth and sixth, where the Typewriter children are one month younger. The mental age averages show that the Experimental children average from one to four months lower in mental age than the Control children in all grades except the fourth. The intelligence quotient averages show that the Control children are slightly brighter than the Experimental in four grades, equally bright in grade five, and a shade less bright in grade four. The initial achievement test averages show that the Experimental and Control groups are equal in three grades, and that the Experimental groups are slightly superior to the Control in the other three grades. Some of the differences in favor of the Control groups are large in relation to their probable errors, but, on the whole, this chart indicates that the Experimental and Control groups are on the average closely equal in chronological age, mental maturity, brightness, and initial achievement, with the weight of the differences indicating a slight superiority in learning capacity for the Control children.

The data on which the charts of Chapters II to V, inclusive, are based are presented in detail in the tables in the appendix. The comparisons of Experimental and Control groups in these chapters are made in terms of averages, but the tables also show the variabilities. In general, there are no striking differences in variability, but a more



T	421	547	409	353	393	260	2383
C	535	802	619	620	658	504	3738

Numbers of Pupils

** Unweighted Average*

CHART 1. Comparison of Typewriter and Control Groups in September 1929

This chart shows for the Typewriter and Control pupils in each grade the average chronological age, mental age, intelligence quotient, and the average score on the Gates Reading or Stanford Achievement Tests taken in

careful analysis is being made, and, if the results warrant, will be included in later studies.

Comparative Gains in General Educational Achievement

Having established the approximate equality of the Experimental and Control groups in all respects significant for learning save that the Experimental group had the use of the typewriters, we are now ready to compare the educational gains of the Typewriter and Control groups. While we are interested in the specific influences of the classroom typewriter, our primary concern throughout the investigation has been with the total influence of the typewriter on the general educational progress of the elementary school children. Hence we shall present first the data on gains of the Experimental and Control groups on the broadest educational tests which have been given in each grade.

Comparative gains of Experimental and Control groups on Gates Reading and Stanford Achievement Tests. Chart 2 presents the gains of the Experimental and Control pupils in each grade separately, and also shows the unweighted average of the averages of Experimental and Control gains in all six grades. All gains are expressed in terms of the grade norms furnished by the authors of the Gates and Stanford tests. The gains were computed by converting the average initial and final scores of the Experimental and Control groups into grade units, and subtracting the initial grade status from the final grade status. The bars in Chart 2 represent these differences. For convenience of comparison, the initial grade status of each group in each grade is charted on a straight horizontal line.

The unweighted average of the Typewriter gains in all six grades is 0.82 of a grade, and of the Control gains in all six grades 0.75 of a grade. Thus the gross gain of 2383 Typewriter children exceeds the gross gain of 3738 Control children by 7 per cent of a grade. But this rough summary of the comparative gains of the Experimental and Control groups must be considered cautiously for several reasons. The excess gain of 7 per cent of a grade is based on an unweighted average of the gains in six grades; and, while the gains in all six grades are stated in approximately comparable grade units, the gains for the several grades are based on three different tests. Because of these facts it is not feasible to calculate the probable error of the 7 per cent of a grade advantage, and therefore this generalization is statistically less trustworthy than the indications of the differences found in individual grades for which probable errors are available. Moreover, the question remains of how much of the Experimental excess gain is to be attributed to possible systematic factors such as the superior ratings of the Experimental teachers, and the differential stimulus of the experimental situation for the Typewriter classes. Hence the 7 per cent of a grade excess gain should

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September 1929. Grades one to six are represented by the vertical lines from left to right, the grades being indicated at the top and bottom of the chart. The last vertical line, at the right of the line representing the sixth grade, shows the unweighted average of the six grade averages. The points representing the averages for the six grades are connected for convenience of identification and comparison of Typewriter and Control groups: solid lines connect the Typewriter averages, and dash lines the Control averages. The points of reference from which the age and achievement averages are plotted as deviations are the grade norms given by the authors of the Gates and Stanford tests; the norms for all six grades are represented by points on one horizontal straight line for convenience of comparing Typewriter and Control groups in all grades. The variabilities of the Experimental and Control groups are as nearly equal as their averages, as may be seen in Table A1.

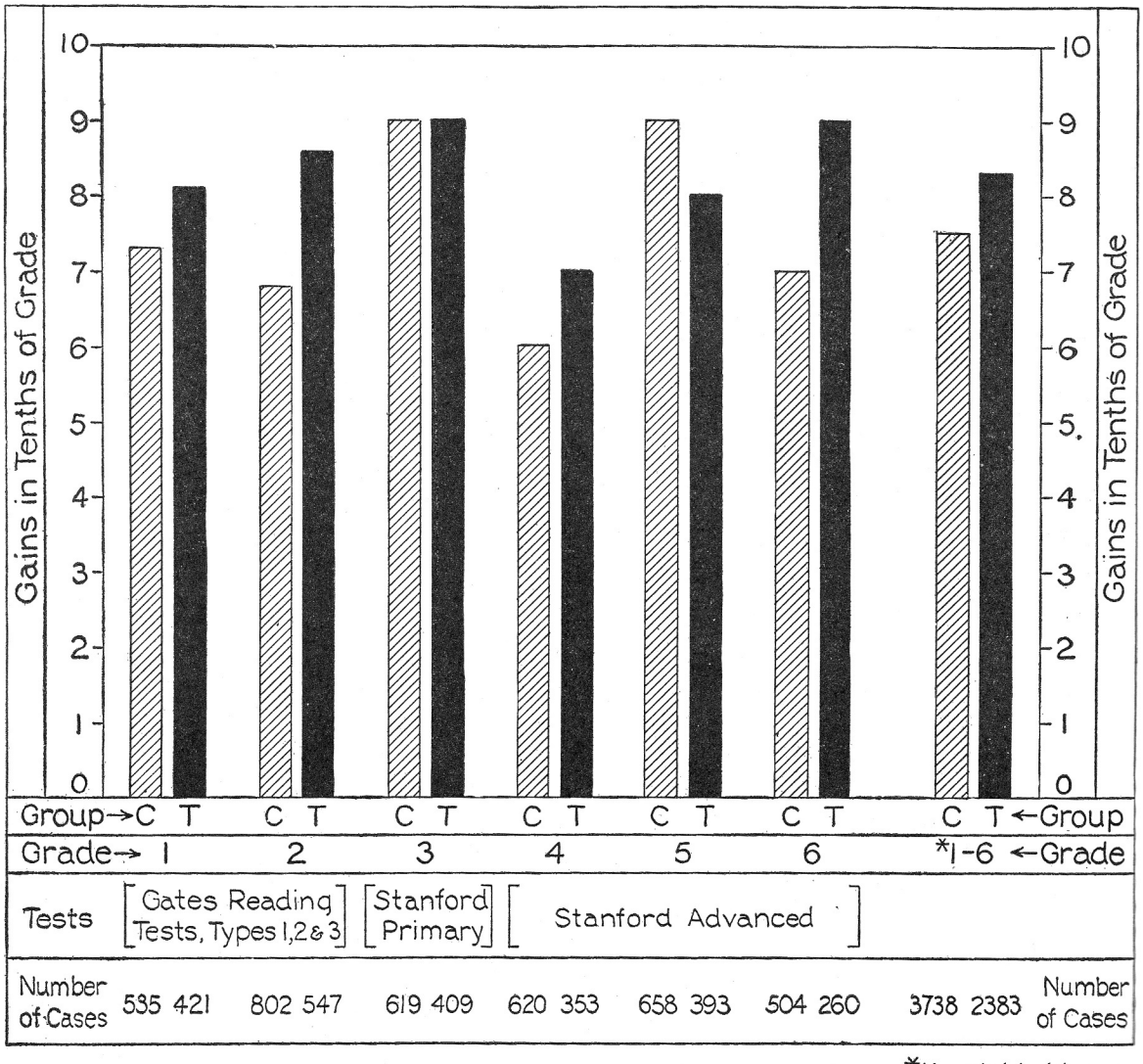


CHART 2. COMPARATIVE GAINS OF TYPEWRITER AND CONTROL GROUPS FROM SEPTEMBER 1929 TO MAY 1930, AS MEASURED BY INDICATED TESTS

The average initial and final scores of each Typewriter and Control grade group were converted into grade units by reference to the norms furnished by the authors of the tests; the difference between these converted averages are here shown by the vertical bars in units of tenths of a grade. The bars are arbitrarily set upon a straight base line for convenience of reading. The absolute initial grade status of each of these groups is shown at the bottom of Chart 1. The black bars represent gains of the Typewriter groups. The unweighted averages of the Typewriter and Control gains in the six grades are shown by the two bars at the right.

be taken as a rough summary of the gross results, to be weighed carefully, rather than as a conclusion to be accepted without reservations. As will be seen in succeeding paragraphs, the excess gain of 7 per cent of a grade cannot by any means be attributed entirely, or even largely, to the direct influence of the typewriters.

Probable errors of excess gains in grades one to six. In grades one and two the gains are based on the averages of three tests, Types 1, 2, and 3 of the Gates Reading Test.

In grade one the Experimental excess gain in the Type 1 test is 1.62 times its probable error, in Type 2 it is more than 6 times its probable error, and in Type 3 it is about 1.5 times its probable error. In grade two the probable errors are much larger in relation to the differences, the ratios of the latter to the former being 0.12, 2.2, and 0.09 for the Types 1, 2, and 3 of the Gates Reading Test, respectively. In grade three the Experimental excess gain on the Primary Stanford test is only 0.866 as large as its probable error.

In the intermediate grades, in which the Advanced Stanford Test was used, the differences between Experimental and Control gains are from two to six times as large as their probable errors. In grades four and six the excess gains of the Experimental pupils are five and six times as large as their probable errors, and in grade five the Experimental excess gain is 2.22 times its probable error.

In calculating the probable errors of the differences between Experimental and Control gains, the gains have been expressed in terms of raw score points, *i.e.*, final test score minus initial test score; whereas in Chart 2 the gains are shown in terms of grade units, *i.e.*, final grade status minus initial grade status. A Stanford raw score point at the sixth grade level means nearly twice as much in terms of grade status as a raw score point at the fourth grade level, and more than twice as much as a raw score point at the third grade level. But this does not invalidate the indications of the probable errors of differences within grade levels. The main consideration here is to establish the relation of the magnitude of the probable error of the difference between Experimental and Control gains in each grade to the magnitude of the difference.

The probable errors, which are shown in detail in Table A2 in the Appendix, should be carefully considered in evaluating the differences between the Experimental and Control gains. In all grades except the second and third, the differences in favor of the Typewriter pupils are significantly larger than their probable errors.

Relative influence of teachers and of typewriters on test gains. In view of the unexpectedly great magnitude, and in view of the statistical significance, of these differences in favor of the Experimental groups, it is important to study in as much detail as possible any factor or factors, other than the presence of the typewriters, which might account in part or in whole for the Experimental excess gains. However large and significant might be the ultimate effects of using typewriters in the primary and intermediate grades, it seems hardly reasonable that the first eight months of experience with the machines should produce an average excess gain of 7 per cent of a grade. Since nothing was taken out of the curriculum, the typewriters probably constituted a temporary addition to the adjustment and learning burdens of both teachers and pupils. In the case of the children in the primary grades it undoubtedly constituted, for a time at least, a greater additional learning burden than in the case of the older pupils. From these considerations it would seem more reasonable to expect that the Typewriter pupils in this experiment would merely hold their own with respect to the general type of educational progress measured by the Gates and Stanford tests; or that if they made excess gains in general educational progress at all, the gains would be small.

The only indication that has been discovered in our data of a systematic factor in favor of the Experimental pupils that might account for their excess gain of 7 per cent of a grade is in the fact that the Experimental teachers received more favorable

ratings from the supervisors than the Control teachers received. As noted on page 24 above, the average rating of the Experimental teachers was 1.47 and of the Control teachers 1.89, on a scale in which 1 was the highest and 5 the lowest rating. While numerically small, the difference of 0.42 is roughly one-half the average standard deviation of the Experimental and Control teacher ratings. In order to ascertain the relation between teachers' ratings and the test gains of Experimental and Control pupils indicated in Chart 2, the following study was made at the suggestion of Professor Truman Lee Kelley of Harvard University.

Intercorrelations of (1) average class gain on the Gates or Stanford tests, (2) teachers' ratings, and (3) presence of typewriters, were computed for (*a*) the 85 Experimental and Control classes in grades one and two; (*b*) the 41 Experimental and Control classes in grade three; and (*c*) the 87 Experimental and Control classes in grades four, five, and six, for whose teachers supervisors' ratings were available. The grades were grouped in this way because the Gates Reading Test was used in grades one and two; the Primary Stanford in grade three; and the Advanced Stanford in grades four to six.

Using these intercorrelations, partial correlations were then computed to show two sets of relations: (*a*) the correlation between test gains and teachers' ratings, with presence of typewriters held constant; and (*b*) the correlation between test gains and presence of typewriters, with teachers' ratings held constant. The form of our argument is that, if (*a*) is positive and statistically significant, then the indication is that the test gains are influenced by the ability of the teachers as indicated by their supervisors' ratings; and if (*b*) is positive and statistically significant, then the indication is that the test gains are the result in part of the influence of the typewriters; and finally, if the difference between the (*a*) and (*b*) partial correlations is statistically significant, the indication is that the influence of one is greater than that of the other.

Most of the partial correlations are small with respect to their probable errors, but in grades one and two they indicate that the ability of the teachers as measured by the ratings had a positive influence on the gains as measured by the Gates Reading Test, and that the influence of the typewriters on Gates Reading Test gains was negligible. The (*a*) partial correlations (that is, the correlations between gains and ratings with typewriters held constant) range from 0.24 to 0.34 ($\pm$ 0.07) for the three parts of the Gates test; while the (*b*) partials (correlations between gains and typewriters with ratings held constant) range from $-$ 0.16 to $-$ 0.02 ($\pm$ 0.07). These correlations are presented in detail in the Appendix in Table A5.

In spite of the small magnitude of these correlations, and their large probable errors, their major indication is that the influence of the typewriters during eight months on gains in reading of the type measured by the Gates test is negligible. As will be indicated more directly later, these data do not, of course, suggest that the typewriters had no positive influence on other educational gains not measured by the Gates test. The difficulty of securing comparable and comprehensive test data on very young children has already been mentioned (Chapter I, page 3). If more varied tests for the primary grades had been available and within our resources, it is probable that indications parallel to those for the intermediate grades would have been obtained for grades one and two.

The (*a*) and (*b*) partial correlations for grade three are so small, 0.08 and 0.08

($\pm$ 0.10), that nothing can be said of their indications with safety. If they mean anything at all, they indicate that the influences of teachers' ratings and of typewriters on educational gains, as measured by the total Primary Stanford Test in grade three, were positive, small, and approximately equal.

In grades four to six the (*a*) and (*b*) partial correlations are also small, but the one indicating typewriter influence is somewhat larger (0.16) than the one indicating teacher influence (0.10). These correlations, like those for grade three, indicate that the influences of teachers' ratings and of typewriters on the Advanced Stanford Test gains of pupils in grades four to six were positive, small, and approximately equal.

While these correlations are all so small with respect to their probable errors that their indications must be accepted cautiously, they afford no evidence that the superiority of the Experimental teachers according to their supervisors' ratings accounts for the excess gains of the Experimental groups in the intermediate grades to a greater extent than the presence of the typewriters accounts for the excess gains. In grades one and two, however, in which we are concerned only with Gates Reading Test gains, the evidence indicates that the typewriters had a negligible influence, and that the influence of teaching ability (as measured by ratings) on reading gains was positive and moderately large. It seems reasonable to suggest, therefore, that the Experimental excess gains in reading in grades one and two may be attributed in large part, if not entirely, to the superior ability of the Experimental teachers in these grades.

Comparative gains of bright, normal, and dull pupils. Various opinions have been expressed regarding the adaptability of the typewriter to bright, normal, and dull pupils. Some observers have suggested that only bright pupils could learn typing well enough to be helped by the machines, and others have suggested that the dull pupils would be helped most. That the typewriter does help dull pupils in certain respects has been observed by us in visiting the classrooms. Many of the teachers have commented on this benefit of the typewriters. But whether it helps the dull more than the bright pupils is another matter. Some of our Experimental teachers, basing their opinions on concrete observations in their own classrooms, have said that the typewriters help the dull more, and others have said the opposite. But most of our Experimental teachers judge that the typewriter helps both the bright and dull groups about equally. If, in the light of Chart 2, and of the partial correlation studies summarized above, we assume that the classroom typewriter has any appreciable influence during the first eight months of its use on test gains, then we may say that the judgment of the majority of the Experimental teachers is sustained by the indications of Chart 3, though this chart gives some indication that the excess gains of the average and superior Typewriter groups are slightly greater than those of either the very bright or dull children.

This chart shows in grade units the average gains of the Experimental and Control children in each grade when they have been divided into five intelligence quotient levels. Of course, the bright Typewriter pupils gained more than the dull, by about one-half a grade. But the bright Control pupils also gained about one-half a grade more than the dull Control pupils. What we must do to resolve this question is to compare the Typewriter and Control gains for each intelligence quotient group. Taking an unweighted average of the Experimental gains and of the Control gains in all six grades in each intelligence quotient group

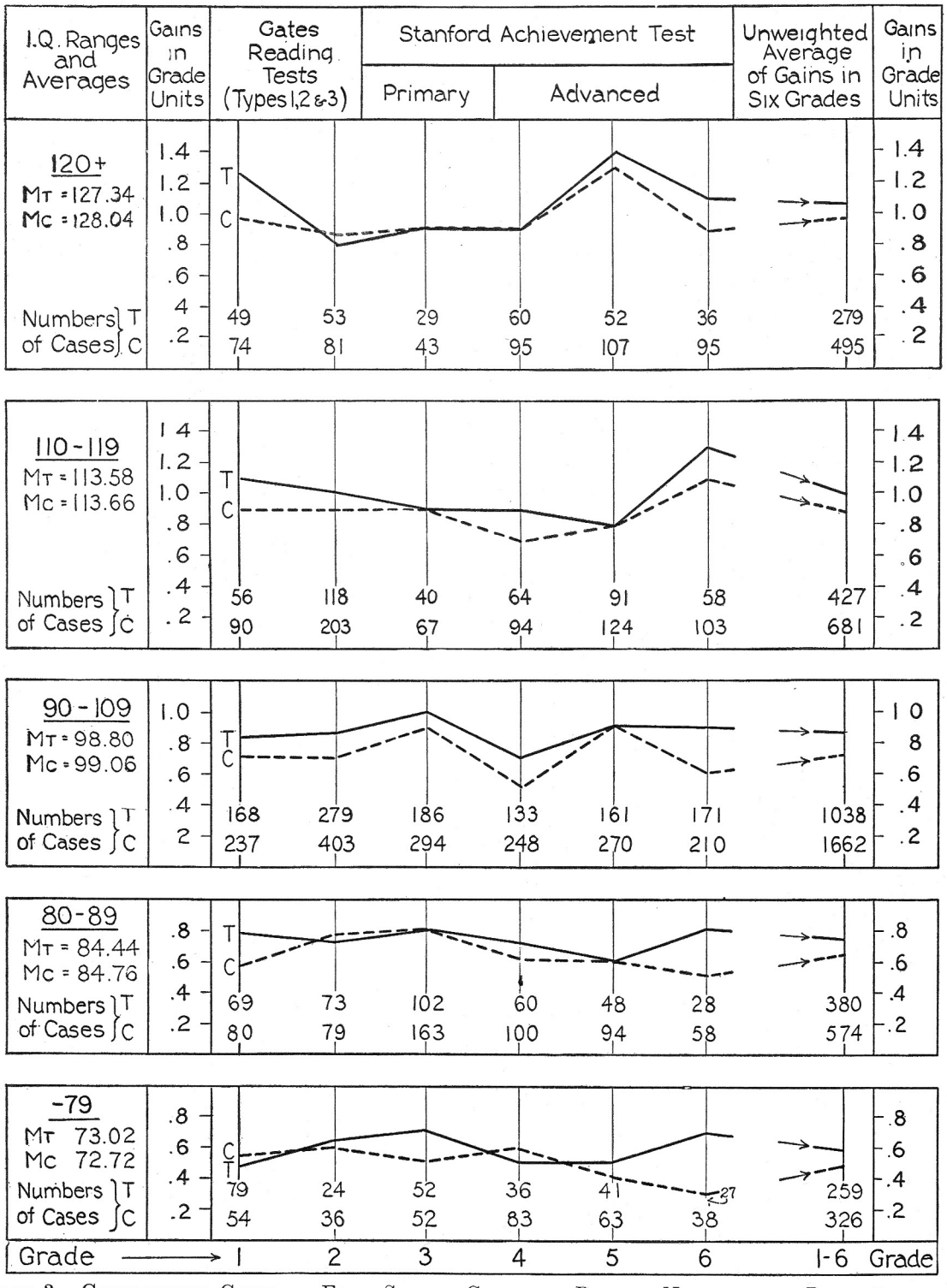


CHART 3. COMPARATIVE GAINS IN EACH SCHOOL GRADE OF BRIGHT, NORMAL, AND DULL PUPILS IN TYPEWRITER AND CONTROL GROUPS

The general plan of this chart is similar to that of Chart 1 above. The gains on indicated tests of the Typewriter and Control pupils in each intelligence quotient level are shown in terms of grade units. The points representing Typewriter gains are connected by solid lines, those representing Control gains by dash lines.

facilitates this comparison. These unweighted averages have been plotted on Chart 3 and show that the gain of the Typewriter children is about equally superior to the Control gain in all five intelligence quotient groups. The greatest superiority of the Typewriter group over the Control group is in the normal and slightly superior groups, that is, in the 90–109 and the 110–119 intelligence quotient levels. The excess gain in these groups averages about 13 per cent of a grade, as compared with about 10 per cent of a grade in the extreme intelligence quotient levels, both bright and dull. Incidentally, the consistent superiority of the Experimental over the Control groups in all intelligence quotient levels is a strong confirmation of the indications of Chart 2. The excess gains in Chart 3 are larger than in Chart 2 because the error due to the use of unweighted averages is cumulative in Chart 3. This error does not, however, notably vitiate the comparisons of the excess gains of the various intelligence quotient groups.

Comparative Gains in Individual Subject Matters

Subject-matter gains in intermediate grades. We have seen from the preceding charts and accompanying discussion that the Typewriter pupils in grades one to six gain more than the Control pupils in general education, in so far as general education has been measured by the tests used. It has been suggested by many observers that the typewriter would help children in certain kinds of achievement more than in others. Since the Advanced Stanford Achievement Test contains ten tests of more or less different kinds of achievement, it is possible to throw some light on these suggestions, although it should be clearly understood that the indications set forth below are very provisional, for obvious reasons.

Averages have been computed of the Experimental gains and of the Control gains in grades three to six on five of the Stanford tests (*i.e.*, those tests included in the Stanford Primary), and of grades four to six inclusive on the other five of the Stanford tests, which are included only in the Stanford Advanced Test. Subtracting the average Control from the average Typewriter gain for each of the Stanford tests, it appears that the excess gains of the Typewriter pupils in some tests are several times as large as in other parts of the Stanford Achievement Examination.

Chart 4 displays these differences and graphically emphasizes the surprising fact that the excess gain of the Typewriter group is greatest in the arithmetic computation test of the Stanford Achievement Examination. It had not occurred to any of us, and no one had ever suggested to us, that the typewriter would be particularly helpful in arithmetic. It was for this reason that the Experimental and Control teachers were originally asked to preserve all pupils' writings *except* the arithmetic papers and written number work. Within a month after the use of the typewriters began, so many Experimental teachers reported that the children were using the typewriters in their arithmetic work, that the exception was rescinded and teachers were asked to save all written materials, including arithmetic work. The unexpected magnitude of the excess gain in arithmetic computation lends a particular interest to the probable errors of all the excess gains shown on Chart 4.

Probable errors of subject-matter gains. The probable errors of the Experimental excess gains on the Stanford sub-tests are shown in detail for grades three, four, five, and six separately in Table A4 in the Appendix. We cannot show directly the probable errors of the unweighted averages of

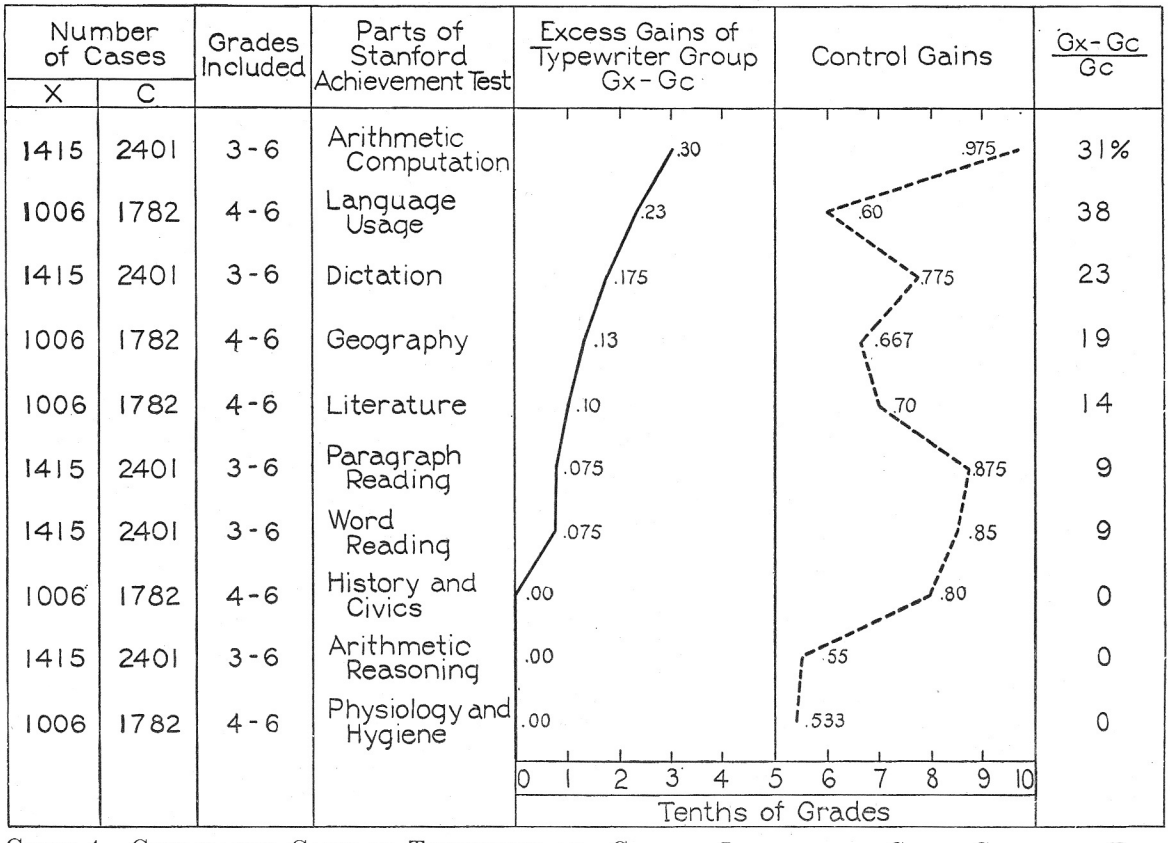


CHART 4. COMPARATIVE GAINS OF TYPEWRITER AND CONTROL INTERMEDIATE GRADE GROUPS ON EACH OF THE TESTS IN THE STANFORD ACHIEVEMENT EXAMINATION

The tests are here arranged in the order of absolute magnitude of excess of Typewriter gains over Control gains, from top to bottom. The excess gain for each test is the difference between the unweighted average of the Typewriter gains in grades three to six, or four to six, and the unweighted average of Control gains in corresponding grades. The Stanford Primary includes only five of the ten tests in the Advanced Examination, hence grade three is not represented in five of the tests. Note that when the Typewriter excess gains are expressed as percentages of Control gains, Language Usage takes first place, and Arithmetic Computation second place; otherwise the order of the tests is the same for both methods of reckoning the magnitude of the Typewriter excess gains.

the excess gains shown in Chart 4, but it is clear from Table A4 (page 190) that the most reliable differences in favor of the Typewriter pupils are in the spelling and arithmetic computation tests. In spelling the Experimental excess gains in grades three to six are from two to nine times their probable errors, the average critical ratio for the four grades being more than four.

The next most reliable differences in favor of the Experimental pupils are the excess gains in geography, word meaning, and language usage, the average critical ratios for the several grades being 2.64, 2.62, and 2.31, respectively. In paragraph reading the Experimental excess gains in grades four and six are 3.35 and 1.59 times the probable errors, but these gains are balanced by slight Control excess gains in grades three and five, which are small fractions of their probable errors. The differential gains in the other parts of the Stanford test are insignificant.

Relative influence of teachers' ratings and of typewriters on subject-test gains. All of the statistically significant gains seem to be within reasonable expectation except that in arithmetic computation. The suspicion of some hidden systematic factor naturally arises. Since the higher average rating of the Experimental teachers mentioned earlier in this chapter is the only indication of a systematic advantage for the Experimental pupils that we have been able to discover, we have studied the relative influence of teachers' ratings and of the presence of the typewriters on the gains of the Experimental and Control pupils indicated in Chart 4. The method is the same as that described on page 30 above, suggested by Professor Kelley, to whom we here make hearty acknowledgments. The correlations used in the following paragraphs are shown in detail in Table A5, in the Appendix.

First, intercorrelations of (1) average class gains in arithmetic computation, (2) teachers' ratings, and (3) presence of typewriters, were computed for the 30 Experimental and 57 Control classes in grades four, five, and six, whose teachers had ratings. The partial correlation between class gains and presence of typewriters, with teachers' ratings held constant, was found to be 0.17. The partial correlation between class gains and teachers' ratings with presence of typewriters held constant was found to be 0.06. In spite of the large probable errors (0.07) of these correlations, this may possibly be a significant difference. At least, it gives no support to the suspicion that the unexpected gain of the Experimental pupils in arithmetic computation was due to superiority of the Experimental teachers, as indicated by the supervisors' ratings. On the contrary, it suggests that the typewriters were more influential than the teachers' ratings in causing the excess gain in arithmetic computation. But the issue is clouded by the corresponding partial correlations based on the 16 Experimental and 25 Control classes in grade three. Here the greater influence of the teachers is indicated by a partial of 0.24, and the lesser influence of the typewriters by a partial of 0.07. These differences emphasize the importance of the large probable errors of the correlations with which we are dealing. The two pairs of partials are consistent only in that both indicate that the influences of typewriters and of teachers' ratings were both positive, and this indication is consistent with all the other evidence available.

With regard to the relative influence of teachers' ratings and of typewriters on gains in the dictation (spelling) test, the partial correlations are more consistent. Using the 87 Experimental and Control classes in grades four, five, and six, the correlation between spelling gains and teachers' ratings, with typewriters held constant, is -0.11; the correlation between gains and typewriters, with teachers' ratings held constant, is 0.32. The corresponding partials based on the 41 Experimental and Control classes in grade three are -0.13 and 0.30. The indications of these two pairs of partials are not only consistent with each other, but are consistent with the teachers' judgments (see Chapters VI and VII). In view of the size of the probable errors, the negative partials here do not carry the conviction that the highly rated teachers *caused* a loss in spelling, any more than the negative partials reported above (page 30) in connection with the Experimental excess gains in grades one and two prove that the typewriters caused a loss in reading. These are probably chance results. It seems safe to conclude, however, that the influence of the typewriters on spelling gains was greater than the influence of the teachers' ratings, and therefore that a considerable part of the

Experimental excess gain in spelling was due to the typewriters.

The other partials which have been computed indicate that the influences of the teachers and of the typewriters on gains in the other subjects connoted by the Stanford sub-tests are small and approximately equal, with a very slight but fairly consistent edge in favor of the typewriters as the more potent of the two influences.

Number of Classes	Grades 4, 5, and 6 $N = 87$		Grade 3 $N = 41$	
	2. *Teachers' Rating* ($r_{12.3}$)	3. *Typewriters* ($r_{13.2}$)	2. *Teachers' Rating*	3. *Typewriters*
Spelling	− .11	.32	− .13	.30
Arithmetic computation	.06	.17	.24	.07
Geography	.17	.19		
Reading — word meaning	.12	.15	− .03	.00
Language usage	.13	.13		
Reading — paragraph meaning	.10	.08	.06	− .05
Physiology and hygiene	− .13	− .01		
Arithmetic reasoning	− .04	.01	− .15	− .07
History and civics	.09	− .02		
Literature	− .04	− .04		

On the whole it seems safe to conclude from these partial correlations that the influences of teachers' ratings and of typewriters on gains were negligible for about half the subjects listed above; and were small and approximately equal in geography, in reading (word meaning), in language usage, in reading (paragraph meaning), and in arithmetic computation. Only in spelling is the evidence consistent that the typewriters make a measurably larger contribution than the teachers' ratings.

But these indications should be taken as merely suggestive. Neither the absolute magnitude of these excess gains nor the order in which the parts of the Stanford test arrange themselves according to the partial correlations summarized above should be regarded as conclusive. Some of the differences are obviously due to chance; and unknown systematic factors may account for some of them. It is quite probable that some of the differential gains shown in Chart 4 are due to particular ways in which the typewriters have been used by the Experimental teachers and pupils during the first year. Although most of the Experimental teachers apparently found it easy to adapt the typewriters to the classroom situation, it is hardly reasonable to suppose that they would discover during the first year all the ways in which the typewriter could be profitably used, nor the best distribution of its use among the various subject matters. This suggestion is sustained by the second year results shown in Chart 12 on page 50.

Handwriting quality. It was a major condition for participation in this experiment that no curriculum change, no deviation from the normal goals of the participating schools, should be suffered on account of the experiment. Reference to the Manual of Directions to Teachers (see page 17) will show that good handwriting was specifically mentioned as a goal which should be pursued in the usual manner. The reports of the teachers and our own observations during the experiment lead us to believe that the children in Typewriter classes secured a normal amount and quality of practice in handwriting. As will be seen in

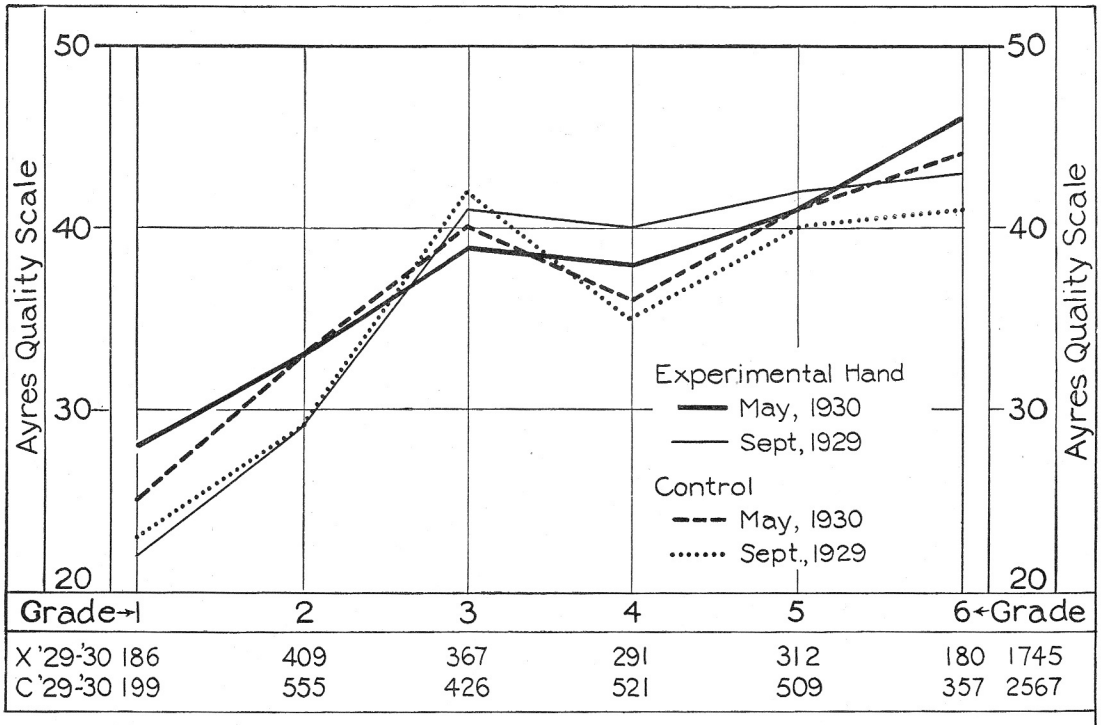
Chapter IV, the quantity of handwriting done by the Experimental groups is greater than that done by the Control groups in grades one and two, slightly less in grades three and four, and measurably less in grades five and six. But the differences are not large enough, in view of the total quantity of writing done, to suggest any measurable changes in handwriting quality. Hence we would expect only small differences, if any, between the handwriting quality of the Typewriter and Control groups after eight months' use of the machines. This expectation seems particularly reasonable so far as the upper grades are concerned, because handwriting habits established by from three to six years of tuition could not be changed to any great extent without some revolutionary change in the amount and quality of handwriting practice.

The material used for the handwriting test consisted of the first three sentences of the Gettysburg Address in September 1929, and of specially constructed texts, suitable in vocabulary and reading difficulty to each grade level, in May 1930. The texts used in May 1930 were also given in November 1929, but because of several unforeseen factors, so few Control students took the November 1929 handwriting tests that statistically reliable comparisons could not be made. Both the initial and final handwriting tests of the Experimental and Control groups were scored during the same month, by the same two research assistants, working in such a way that each handwriting specimen received independent ratings from the two judges. These two ratings, based on the Ayres Handwriting Scale, were averaged for the final rating on each specimen. The median initial and final scores of the Experimental and Control pupils in each grade who took both initial and final handwriting tests are shown graphically in the upper part of Chart 5.

The average initial scores are higher than the final scores in grade three for the Control, and in grades three, four, and five for the Experimental groups. This is probably partly due to the fact that some of the Experimental and Control classes used the Gettysburg Address as handwriting practice material, and partly to the fact that the Gettysburg material was more familiar to all the children than the specially constructed texts used in the final test. Since we do not know the percentages of Experimental and Control groups using the Gettysburg text, and since the frequency of such use might not occur in a chance manner, we cannot place the usual confidence in the differences found.

However these inversions of initial and final average scores may be explained, it seems from Chart 5 that, considering the six grades together, the Experimental and Control groups stand approximately in the same relation to each other at the end as at the beginning of the first eight months of using the classroom typewriters. In grade one the initial inferiority of the Experimental group is transformed into a measurable superiority in the final average scores; in grades two and three the Experimental and Control groups stand in the same relation at the end as at the beginning of the year; in grades four and five the Experimental superiority is somewhat less at the end than at the beginning of the year; and in grade six the Experimental group is as superior to the Control group at the end of the year as at the beginning.

The absence of any pronounced difference between the Experimental and Control groups is confirmed by the indications of the lower part of Chart 5, which shows the median initial and final scores of all Experimental and all Control children in each grade who took either an initial or a final test, or both initial and final tests. While



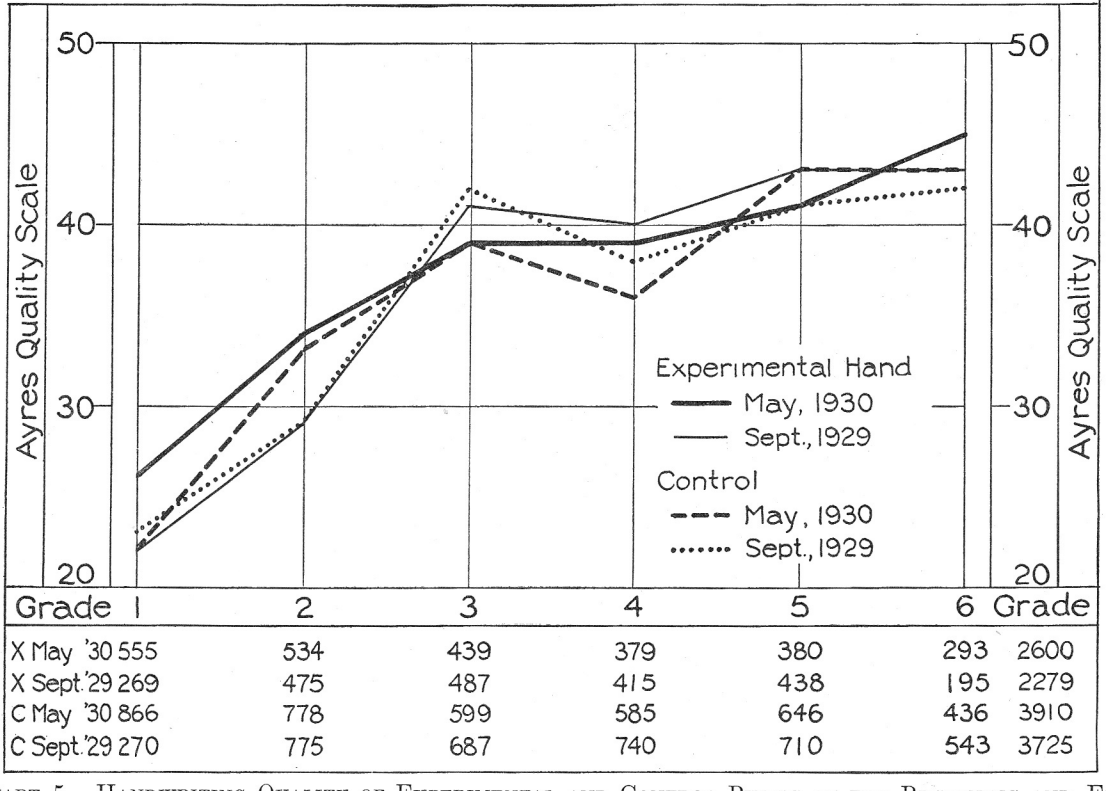


CHART 5. HANDWRITING QUALITY OF EXPERIMENTAL AND CONTROL PUPILS AT THE BEGINNING AND END OF THE FIRST YEAR OF THE EXPERIMENT

The points connected by the lines at the top indicate initial and final median scores on the Ayres Handwriting Scale of all Experimental and Control pupils in grades one to six for whom both September 1929 and May 1930

the initial and final medians in this chart do not represent matched groups, the numbers of cases are roughly 50 per cent larger than the numbers of matched cases represented by the lines in the upper part of Chart 5.

It should be noted that both the Experimental and Control groups are below the Ayres norms in average handwriting quality in the upper grades. This may be due in part to less emphasis on handwriting instruction in the schools that participated in the experiment, but it is more likely due to the severity of the rating standards used by the two research assistants who judged the quality of both Experimental and Control handwriting samples represented in Chart 5. All that can be said here is that the rating standard was the same for both Experimental and Control groups; and that according to the superintendents, supervisors, principals, and teachers, the handwriting instruction was the same for the Experimental and Control groups in each city, except for whatever difference was created by the use of the typewriters in the Experimental classes.

In the light of all these considerations, about all we can conclude is that we have no clear evidence of any effect of the typewriters on handwriting quality.

Handwriting rate. The handwriting quality tests were also scored for handwriting rate, with the results shown in Chart 6. The indications here are that the Experimental groups in all grades write somewhat faster at the end of the year than the Control groups, in spite of a slight initial disadvantage. The Experimental children gain an average of about two words per minute during the year, while the Control children gain an average of about one word per minute in handwriting rate.

Taken together, Charts 5 and 6 indicate that the Experimental children suffered no loss and made no significant gain in terms of handwriting quality or handwriting rate as a result of using the typewriters during one school year.

Typewriting rate. It is obvious that the classroom typewriter can hardly contribute to the educational advancement of children unless the children can learn within a reasonable period of time to typewrite with satisfying speed and accuracy. Both the typewriting rate and accuracy achieved by pupils at the end of each grade, and the speed with which they approach this end-grade status, are crucially important from the viewpoint of the educational value and practical pedagogy of the classroom typewriter. In this experiment the children were introduced to the machines quite informally, by teachers 90 per cent of whom had never used a typewriter before, and of whom less than 2 per cent had any real familiarity with typewriters or skill in typing. Moreover, there was no attempt at formal teaching of typing, or of touch typing, except in a few classes in two or three of the Experimental schools.

Chart 7 shows the median hand and typing rates at the end of each grade of 2143 Experimental pupils who took both hand and typing rate tests in May 1930, together with corresponding Control medians of 3910 pupils in grades one to six.

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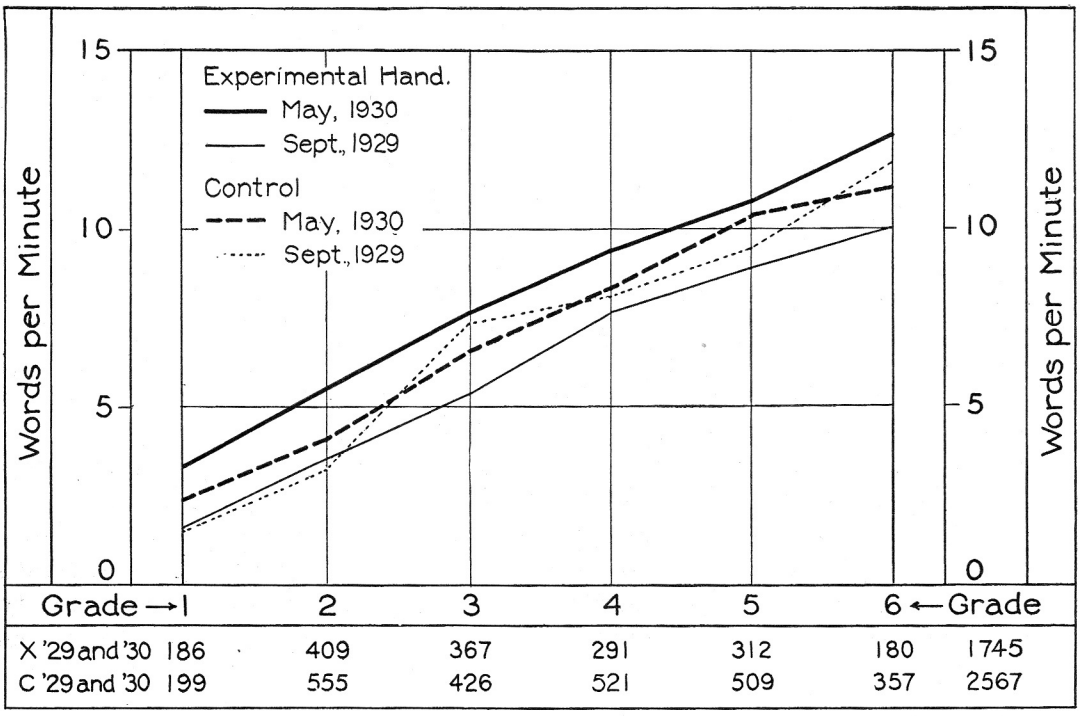
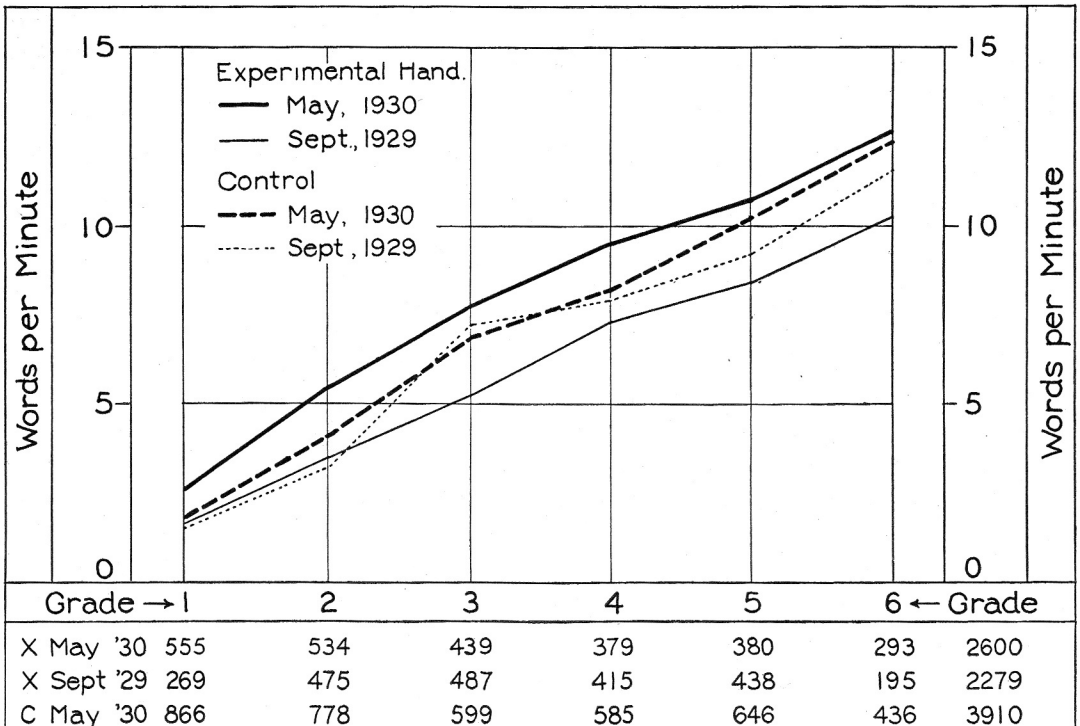
handwriting samples were available. The lines at the bottom represent medians of all Experimental and Control pupils for whom a handwriting sample was available in September 1929 or May 1930. All samples, both initial and final, were scored in August 1931 by two research assistants working in such a way that each sample received two independent ratings, which were averaged.

In September 1929 the first three sentences of the Gettysburg Address were used; in May 1930 specially prepared texts for each grade were used. The fact that many classes above grade two had used the Gettysburg Address for handwriting practice, and the newness of the texts used in May 1930, made the initial handwriting test "easier" than the final.



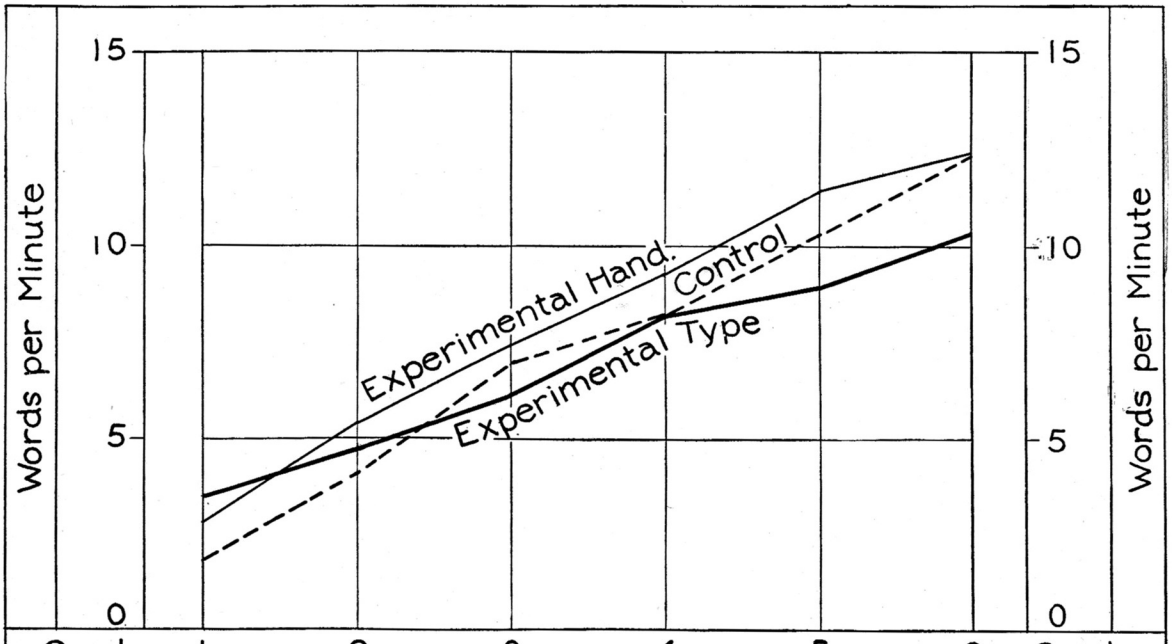
X '29 and '30	186	409	367	291	312	180	1745
C '29 and '30	199	555	426	521	509	357	2567



X May '30	555	534	439	379	380	293	2600
X Sept '29	269	475	487	415	438	195	2279
C May '30	866	778	599	585	646	436	3910
C Sept. '29	270	775	687	740	710	543	3725

CHART 6. HANDWRITING RATE OF EXPERIMENTAL AND CONTROL PUPILS AT THE BEGINNING AND END OF THE FIRST YEAR OF THE EXPERIMENT

This chart is parallel to Chart 5, and is based on returns from the same groups of children.



Grade →	1	2	3	4	5	6 ← Grade	
X Type May'30	480	444	313	337	317	252	2143
X Hand May'30	480	444	313	337	317	252	2143
C Hand May'30	866	778	599	585	646	436	3910

CHART 7. RATES OF TYPEWRITING AND OF HANDWRITING OF MATCHED GROUPS OF EXPERIMENTAL PUPILS, AND OF TOTAL GROUP OF CONTROL PUPILS IN MAY 1930

The solid lines show median handwriting and typing rates of 2143 Experimental pupils who had both handwriting and typing rate tests in May 1930. The dash line connects median points for the 3910 Control pupils described in Chart 5.

This chart indicates that the Experimental pupils in eight months achieve typing rates that exceed the Control hand rates in grades one and two, and are one or two words per minute lower than the Control hand rates in grades three, five, and six. The typing rate exceeds the Experimental hand rate in grade one. These findings recall the conclusion given by Professor Thorndike and his associates in an article [1] published nearly twenty years ago to the effect that "forty hours of well-distributed practice will enable an intelligent student to copy on the machine approximately as fast as he can by hand." Professor Thorndike's results apply to adult students. The excess of the typing rate in grade one over both Experimental and Control hand rates is noteworthy, and confirms other evidence in this report of the special values of the typewriter for young children who are in the earliest stages of learning to write.

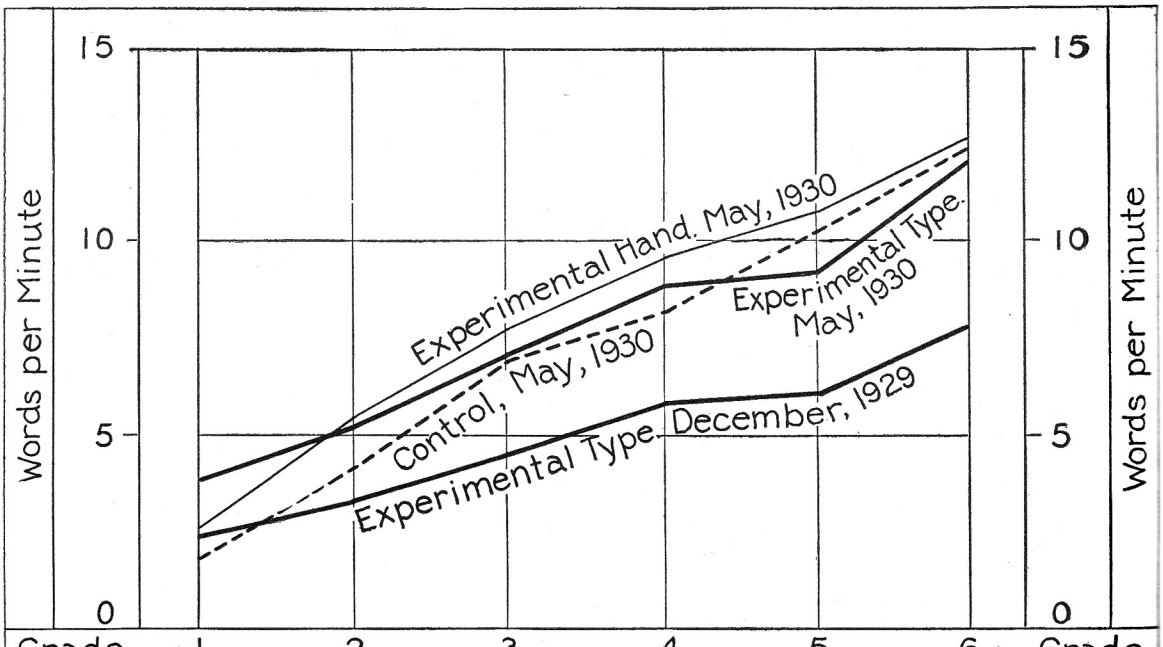
The indication that normal groups of children can in one school year achieve a typing rate which exceeds by a notable margin the Control hand rate in grade one, which equals or slightly exceeds the Control hand rate in grades two and four, and which approximates the hand rate achieved in three to six years of practice in grades three, five, and six, is of considerable educational significance.

[1] Hill, L. B., Rejall, A. E., and Thorndike, E. L.: "Practice in the Case of Typewriting," *Pedagogical Seminary*, December 1913, Vol. XX, pp. 516–529.

But the speed with which this end-grade rate is achieved is equally important. Typing rate tests comparable to those given in May 1930 were also given in December 1929, approximately ten or eleven weeks after the children had begun the use of the typewriters. December 1929 and May 1930 tests were matched for 2057 pupils, so that average typing rates for December and May could be computed for a fairly large group in each grade, as shown in Chart 8.

It is clear from Chart 8 that in about ten to eleven weeks the Experimental pupils could typewrite more than half as many words per minute as they wrote eight months after beginning the use of the classroom typewriter. It was probably this celerity of acquiring speed on the machines, no less than the variety and satisfyingness of what the children were able to write on the machines, that accounts for the strong appeal of the typewriter for the children and for the favorable educational influence indicated in preceding charts, and in later chapters of this report.

Typing error index. That the typing rates just discussed were not achieved at the expense of high error rates is indicated by the studies summarized in Chart 9. The error index is based on the typing errors found in the typing rate tests. For each typing rate test the error index is the quotient of the number of typing errors, of all kinds whatsoever, divided by the total number of strokes on the typewriter used in whatever was written on the rate test.



X Type '29-'30	345	450	339	324	362	237	2057
X Hand May'30	555	534	439	379	380	293	2600
C Hand May'30	866	778	599	585	646	436	3910

CHART 8. MEDIAN TYPING RATES OF EXPERIMENTAL PUPILS IN DECEMBER 1929 AND MAY 1930, BASED ON RETURNS FROM ALL PUPILS WHO HAD TYPING RATE TESTS BOTH IN DECEMBER 1929 AND MAY 1930

The May 1930 handwriting rates of Experimental and Control groups represented in Chart 7 are shown for general orientation purposes.

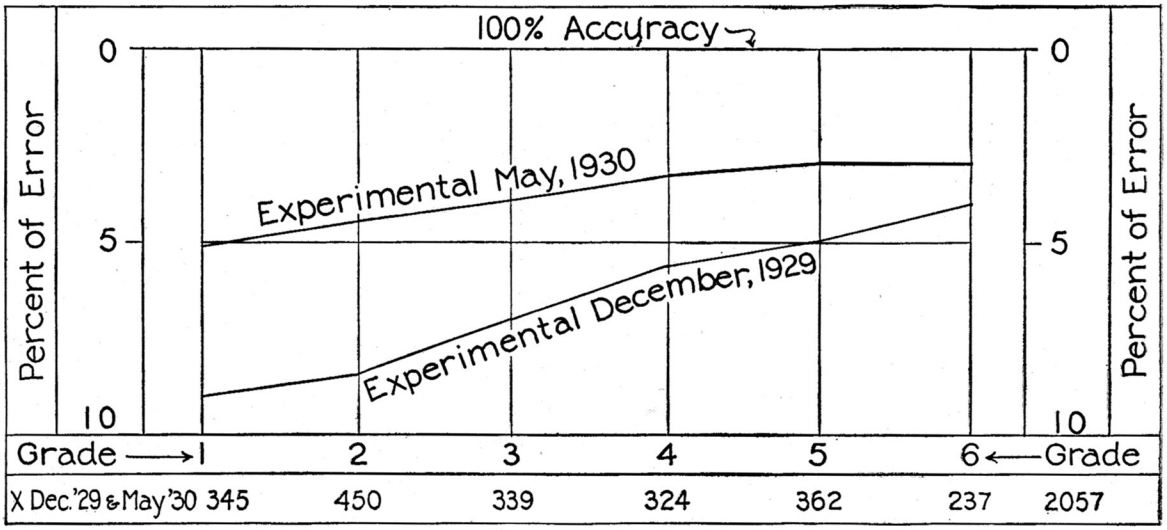


CHART 9. TYPING ERROR INDEX MEDIANS OF 2057 PUPILS WHO TOOK TYPING RATE TESTS BOTH IN DECEMBER 1929 AND IN MAY 1930

Chart 9 shows the median error index in each grade for all pupils who took both the December 1929 and May 1930 typing rate tests.

It is apparent that the pupils achieve a high degree of accuracy in typing after eight months' use of the classroom typewriter, and that they approach the end-grade accuracy very rapidly. This is notably the case in the upper grades. In December 1929, after ten or eleven weeks of using the typewriters in the classroom, the median error index of the children in grades four and five is less than 6 per cent, and in grade six, 4 per cent; the May 1930 median error index is about 3 per cent for all three of these grades.

In December 1929 in grade one, 9 per cent of the strokes made on the typewriter were errors, and in grade two, $8\frac{1}{2}$ per cent were errors. In May 1930 the median error index decreased to about 5 per cent for grade-one and to $4\frac{1}{2}$ per cent for grade-two pupils.

CHAPTER III

ACHIEVEMENT TEST RESULTS: SECOND YEAR

Introduction

In the preceding chapter indications were presented of superior gains in some subject matters associated with the first year's use of the classroom typewriter. Are these indicated advantages only momentary, or do they persist with further use of the machines? Does the experience gained by both teachers and pupils with the machines during the first year lead to greater advantages during the second year? It was with a view to throwing light on these and related questions that the experiment was extended through a second school year. The test results for the second year will now be presented in a manner closely paralleling the presentation of the first-year results in the preceding chapter.

Second-Year Gains in General Educational Achievement

Plan of second-year comparisons. The primary consideration in studying the second-year test results is to compare the second-year with the first-year gains of the same pupils. The Gates Reading Tests, Types 1, 2, and 3, and the Stanford Achievement Tests were given in May 1931 to all pupils in the same grades as in September 1929 and May 1930; but we shall here consider only the test results from those pupils who had been in typewriter classes from September 1929 to May 1931 in the six cities which supplied corresponding test data for the preceding chapter.

Number of second-year typewriter pupils. Since we are here concerned only with pupils who were in Typewriter classes two full school years, we can consider the pupils in five grades only, *i.e.*, only pupils who were in grades two to six in May 1931, and mainly in grades one to five in May 1930. In order to maintain comparability, we shall use only the test results of those pupils in these five grades who took the full series of Gates and Stanford tests in September 1929, May 1930, and May 1931. Thus the number of Typewriter pupils whose second-year gains can be compared with their own first-year gains is only 1435.

Equality of learning conditions in first- and second-year groups. The schools that served as Experimental schools in the second year were the same as those that served as Experimental schools in the first year. The total numbers of Typewriter teachers and pupils in the second-year Typewriter classes were practically the same as in the first year; but between one-third and one-half of both teachers and pupils in these second-year Experimental classes had not been in the first-year Experimental classes. Our second-year Experimental groups were therefore fairly well mixed with teachers and pupils who were new to the experiment. While in this chapter we shall consider the test data only of those pupils who were in Typewriter classes both years, we must remember that about one-third of these two-year Typewriter pupils had teachers during the second year who had not had a previous year's experience with the classroom typewriter.

We failed to secure comparable ratings on the teachers who were new to the

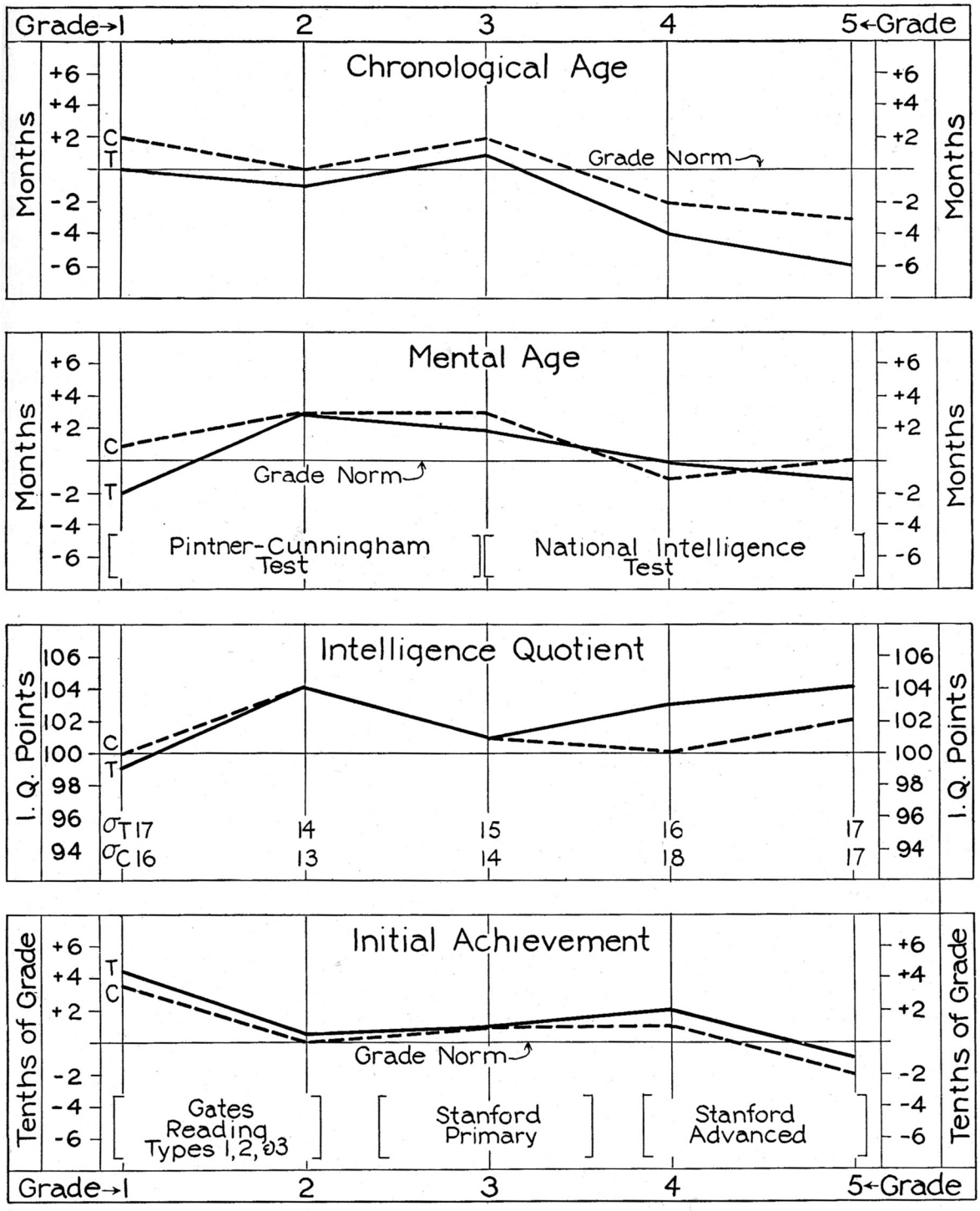


CHART 10. COMPARISON OF SECOND-YEAR TYPEWRITER GROUPS WITH CONTROL GROUPS ON THE BASIS OF AGE AND TEST DATA SECURED IN SEPTEMBER 1929

This chart is parallel in form and content with Chart 1, and should be read in a similar manner. The variabilities of the Experimental and Control groups are as nearly equal as their averages, as may be seen in Tables A1, A8, and A9.

experiment in the second year, but the supervisors and principals gave assurance that the second-year Typewriter teachers were closely equal in training, experience, and ability to the first-year Experimental teachers. Seventy of the second-year Experimental teachers were among the first-year teachers on whom ratings were secured during the first year. Their average rating was 1.54, which is slightly lower than the average rating (1.47) of all first-year teachers on whom ratings were available. (See above, page 24.) Seventy-nine of the second-year Experimental teachers were among the first-year Typewriter teachers for whom we secured training and experience data; they averaged 13.77 years of teaching experience, 9.49 years of local tenure, 3.59 semesters of college training, and only .80 of a summer school session. Reference to Table 3, page 24 above, will show that these averages are somewhat lower than those of the entire group of first-year teachers for whom training and experience data were available.

Initial achievement, intelligence, and chronological age of second-year Experimental pupils. While the primary comparisons with which we are here concerned are between the first- and second-year test gains of the *same* pupils, it is of considerable importance to know how the smaller second-year group compares with the total first-year group, and with the Control group, with respect to initial achievement, intelligence and chronological age at the beginning of the experiment in September 1929.

Since the selection of the 1435 Typewriter pupils for the second-year study was random in nature, all pupils being included who took the Gates or Stanford tests in September 1929, May 1930, and May 1931, we would expect them to be approximately equal to the larger first-year group from which they were selected, and therefore about equal to the Control children in corresponding grade groups. Chart 10, which parallels Chart 1, shows that this expectation was approximately fulfilled. In average chronological age and mental age the second-year Typewriter pupils are one to three months younger than the Control pupils; the intelligence quotient averages are practically identical for the Typewriter and Control in each grade. In initial achievement in September 1929 the second-year Typewriter children are somewhat superior to the Control children in three grades and equal in the other two grades. The variabilities of the Experimental and Control groups are as closely equal as the averages graphed on Chart 10. (See Tables A1, A8, and A9.)

The second-year Experimental pupils took the tests three times, in 1929, 1930, and 1931, whereas the Control pupils took them only twice, in 1929 and 1930. While the pupils in both Experimental and Control schools were used to taking objective tests before the experiment began, and while there is no clear evidence of a pronounced practice effect, it is obvious that whatever practice effect there was would tend to make the Experimental gains in the second year spuriously large. The reader must be the judge of these and other complex conditions involved in evaluating the indications of the second-year data.

The probable errors of the Experimental and Control differences reported in this chapter have not been calculated for the double reason that the order of the probable errors for these differences may be judged from those reported for corresponding differences in the preceding chapter, and that the possible influences of the systematic factors just mentioned may so far outweigh considerations of statistical reliability that the probable errors might be misleading or at least pointless.

Second-year gains on Gates Reading and Stanford Achievement tests. Chart 11 shows the first- and second-year gains of 1435 Typewriter pupils who were in grades two to six in 1930–31, and mainly in grades one to five in 1929–30. The gains of the Control groups in grades one to six in 1929–30 are shown for general orientation purposes. This chart closely parallels Chart 2 in the preceding chapter. The cross-hatched bars represent the 1930–31, or second-year gains of the Typewriter pupils, and the black bars represent their 1929–30, or first-year gains.

Because of the limited resources at our disposal, Gates and Stanford tests, unfortunately, were not given to the Experimental classes in September 1930. Hence the second-year gains shown on Chart 11 are twelve-month gains, from May 1930 to May 1931, while the first-year gains are eight-month gains, from September 1929 to May 1930. In order to make these gains comparable, they must be reduced to the same time basis. This cannot be done by taking eight-twelfths of the second or twelve-eighths of the first, since growth in the functions measured by these tests is not

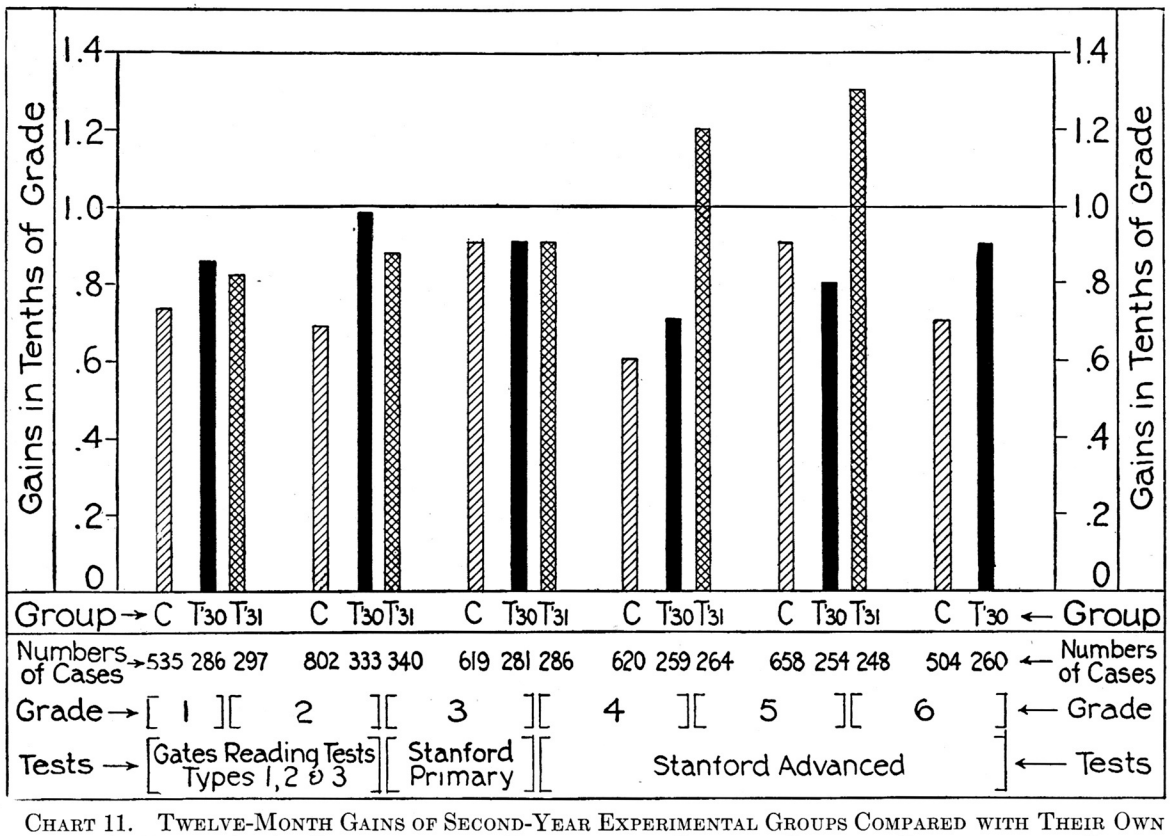


CHART 11. TWELVE-MONTH GAINS OF SECOND-YEAR EXPERIMENTAL GROUPS COMPARED WITH THEIR OWN FIRST-YEAR EIGHT-MONTH GAINS AND WITH EIGHT-MONTH CONTROL GAINS IN CORRESPONDING GRADES

The black bars represent gains of second-year pupils when they were in grades one to five, and the cross-hatched bars when they were in grades two to six. The children who were in the sixth grade group in 1929–30 passed out of the experiment in June 1930, but their average gains are represented by the two bars at the right to facilitate grade-to-grade comparisons of first- and second-year groups. The groups represented by each pair of black and cross-hatched bars are made up of identical individuals to an extent of more than 90 per cent; the groups are not entirely identical because of a few double promotions, including a few from kindergarten in 1930 to grade two in 1931, and a larger number of non-promotions.

proportional to time throughout a calendar year.

According to the Stanford Achievement Test Manual, pupils starting at grade in September, for example at grade 4.00, will normally reach a grade status of 4.80 in the following May, and during the following four months, including the vacation period, will normally grow 0.20 of a grade, reaching the 5.00 grade status on September 15. If 20 per cent of a calendar year's growth in Stanford grade status occurs during the May–September period, then we should reduce the Typewriter pupils' second-year twelve-month gains by 20 per cent in order to make them comparable with their first-year eight-month gains from September 1929 to May 1930.

The unweighted average of the second-year gains of the Typewriter groups is 1.018 of a grade; the unweighted average of their first-year gains is 0.846 of a grade. Applying a correction of 20 per cent, the average of second-year gains becomes 0.8144 of a grade. This correction seems to us to be too large.

Correspondence with Professor Truman Lee Kelley of Harvard University, one of the authors of the Stanford Achievement Test, indicates that the growth of 20 per cent assigned to the period from May to September is too large. While he does not claim exactness or finality for the following distribution of gains for the calendar months, the table is based on his observations and on certain unpublished data in his possession.

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Stanford Manual . . .	.00	.10	.20	.30	.40	.50	.60	.70	.80	.90	.93	.97	1.00
Professor Kelley's Estimate	.00	.11	.22	.33	.43	.56	.63	.80	.92	1.06	1.04	1.02	1.00

If, in accordance with the estimate which Professor Kelley has kindly furnished, we assume that only one-tenth of the May 1930–May 1931 gain of the Typewriter pupils occurred in the period May 1930 to September 1930, and if we reduce that gain by one-tenth, the corrected Typewriter gain during the second school year in which they used the machines becomes 0.916. This corrected gain is 7 per cent of a grade larger than their gain in the first year, and about 16 per cent of a grade larger than the unweighted average of the Control gains in all six grades.

It should be noted that in these calculations, we have included the gains of grade two, which are based on the Gates Reading Test, and of grade three, which are based on the Gates test in the first year and the Stanford Primary in the second year. It seems reasonable to assume that the primary grade pupils, whose learning in the early stages of reading depends so much on the teacher and on the school environment, would gain less during the vacation months than the children in the intermediate grades; so that a smaller reduction, if any, should be applied to the second-year average gain in order to make it comparable with the first-year average gain in the early grades. Even so, however, it is apparent that the second-year Typewriter gains in the two lowest grades are smaller than their first-year gains, the uncorrected unweighted average of the former being 0.845 and of the latter 0.915 of a grade. When corrected to the extent of 10 per cent, the second-year average gain is only 0.761 of a grade, which seems scarcely credible in view of the other evidence. A second-year gain of 0.761 of a grade following a first-year gain of 0.915 of a grade casts doubt upon both measures. If the first-

year gain is spuriously high, then the second-year gain is very probably spuriously low, since the latter is measured from the May 1930 test average. It is not improbable that the correction of 10 per cent is too large, and since we do not know that the Gates and Stanford grade units are more than approximately comparable, it is also possible that a part of the deficiency in the second lowest grade group may be due to the fact that the first-year gain is in terms of Gates Reading Test grade units and the second-year gain is in terms of Stanford Primary Test grade units. If the educational progress of the second- and third-grade Typewriter children was as great in the second year as in the first, it was progress in a type of achievement not comparably measured by the Gates Reading and the Stanford Primary tests.

In grades four, five, and six, the second-year Typewriter gains appear to be considerably larger than the first-year gains. If we apply the correction to these three grades, in which only Stanford tests were used, and in which, therefore, comparability of first- and second-year gains is more sure, the excess of second-year Typewriter gains over first-year gains remains large, even when we apply the 20 per cent instead of the 10 per cent reduction. For these three grades the unweighted average of first-year Typewriter gains is 0.80, and of second-year Typewriter gains 1.13 of a grade. Reducing this gain of 1.13 by 20 per cent leaves a corrected Typewriter gain for the second year of 0.904, which exceeds the first-year Typewriter gain by 10 per cent of a grade, and exceeds the average Control gain by 17 per cent of a grade. While excess gains of this magnitude cannot be attributed to any one instructional device, such as the classroom typewriter, it is possible that the second year of using the machines has made a greater contribution to pupils in the intermediate than in the primary grades, although it must be remembered that only the Gates Reading Test was used in grades one and two.

In view of the uncertainties involved in the second-year Gates and Stanford test data, these differences must be considered cautiously, and reasonable allowance should be made for the possible systematic factors mentioned earlier in this chapter. On the whole, it seems safe to conclude that the second-year test data are in harmony with those of the first year in indicating superiority of Experimental over Control gains, but that, in spite of the large excess gains in the upper grades, the evidence is not clear enough to warrant the conclusion that the Typewriter accelerated second-year gains beyond first-year gains, or that it had a differential influence as between the lower and upper grades.

Comparative gains of intermediate grade groups in individual subject matters in the second year. Chart 12, which is parallel to Chart 4 described in the preceding chapter, shows the subject matters connoted by the ten tests of the Stanford Achievement Test in the order of magnitude of the excess of second-year Typewriter gains over Control gains. The primary comparison here is between second-year Experimental and Control gains rather than between first- and second-year Experimental gains, so as to make Chart 12 as directly comparable as possible with Chart 4. But the first-year gains of the second-year Typewriter pupils are also shown in Chart 12, so that the first- and second-year gains of practically identical groups of Experimental pupils may be compared. With the exception of arithmetic computation and spelling (dictation) the order of the sub-tests according to the excess of second-year over first-year gains of the two-year Typewriter groups is approximately the same as the order according to excess of second-year Experimental over Control gains.

The 1930–31 Experimental excess gains graphed in Chart 12 are too large by at least 10 per cent, since they represent the difference between twelve months of growth of the Experimental groups and only eight months of growth of the Control groups. In order to compare the second-year with the first-year excess gains, the former must

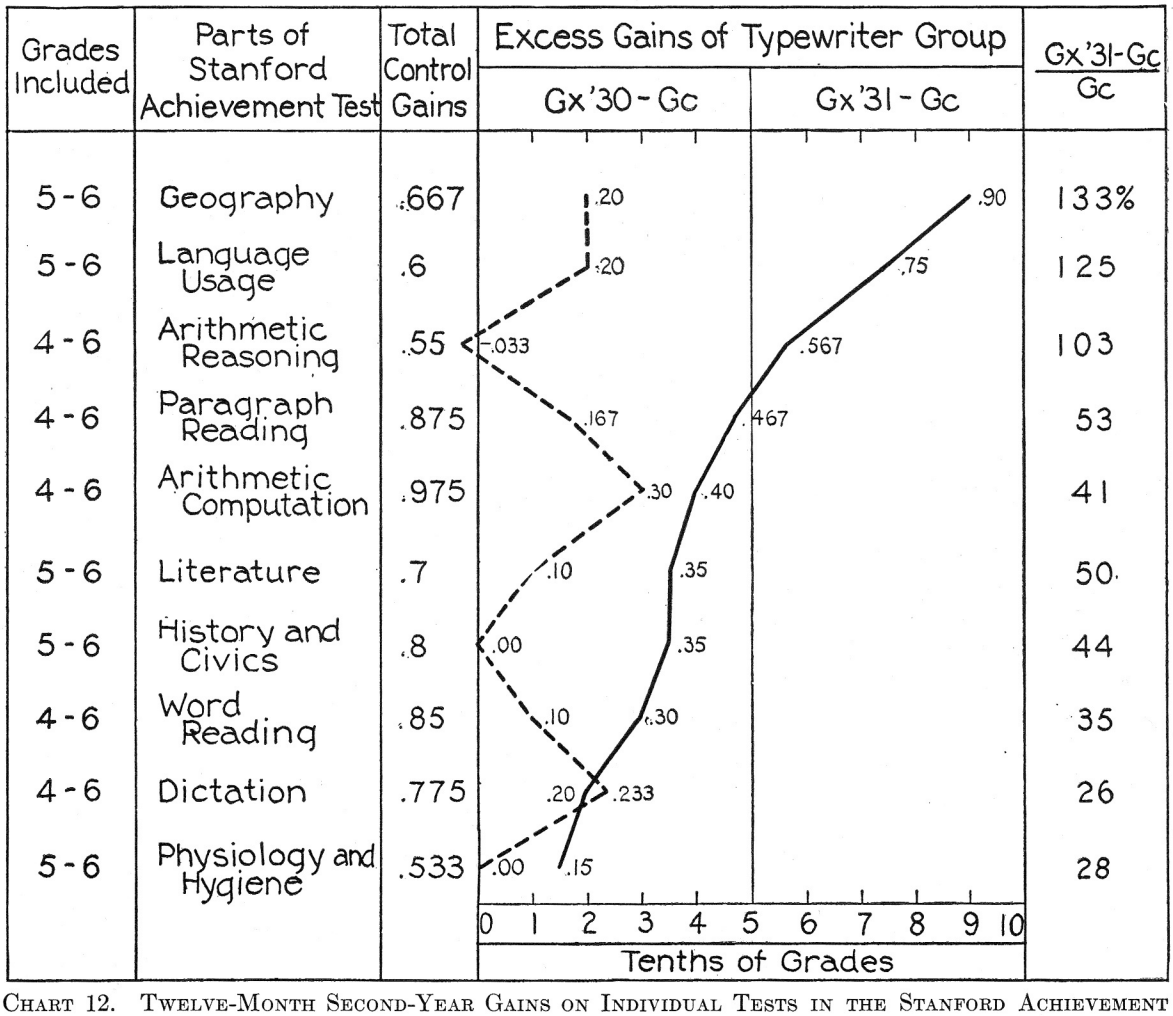


CHART 12. TWELVE-MONTH SECOND-YEAR GAINS ON INDIVIDUAL TESTS IN THE STANFORD ACHIEVEMENT EXAMINATION OF EXPERIMENTAL INTERMEDIATE GRADE GROUPS COMPARED WITH EIGHT-MONTH CONTROL GAINS IN CORRESPONDING GRADES IN 1929–30

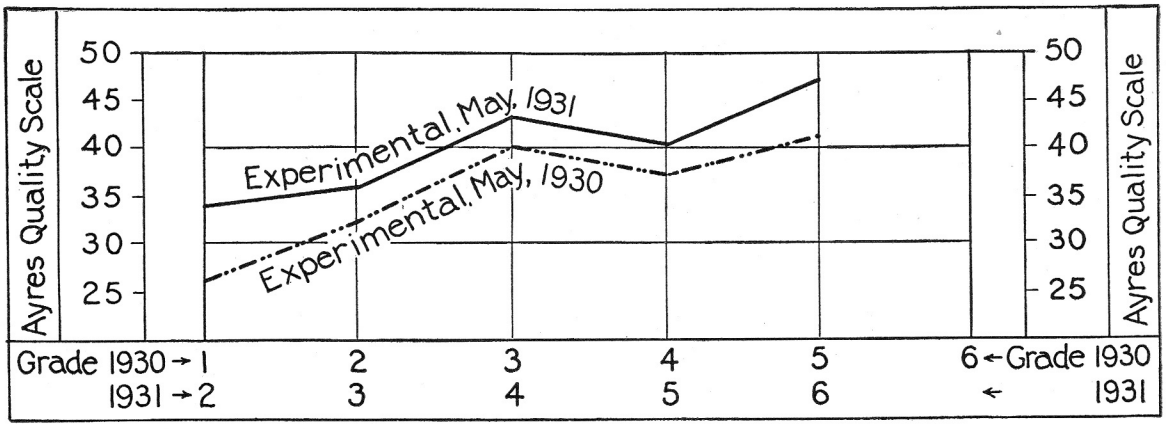
The vertical line marked zero is the point of reference for the chart; it represents the Control gains shown numerically by the figures immediately to the left of the line. The solid line at the right shows the excess of Experimental over Control gain in each of the ten Stanford sub-tests. The excess in each case is the difference between the unweighted average of Experimental gains in grades four to six, or five to six, and the unweighted average of Control gains in corresponding grades. The dash line shows the 1929–30 excess of Experimental over Control gains for the same groups of pupils as are represented by the solid line. The distance between corresponding points on the solid and dash lines shows the excesses of second- over first-year gains of the same groups of Experimental pupils. With the exception of arithmetic computation and spelling the order of the sub-tests according to these distances ($G_{x'31}-G_{x'30}$) is approximately the same as the order according to the excess gains shown by the solid line ($G_{x'31}-G_c$). The second-year Experimental excess gains are expressed in the last column at the right as percentages of total Control gains. The 1930–31 Experimental excess gains shown here are too large for the reasons explained in the text; they should be reduced by at least 10 per cent.

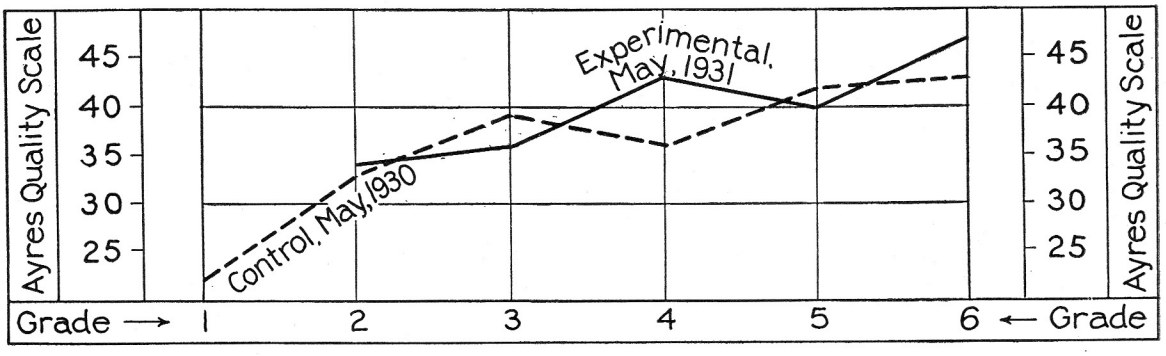
be reduced by at least 10 per cent. But the order of magnitude of excess gain in the subject matters represented by the ten Stanford sub-tests would remain the same.

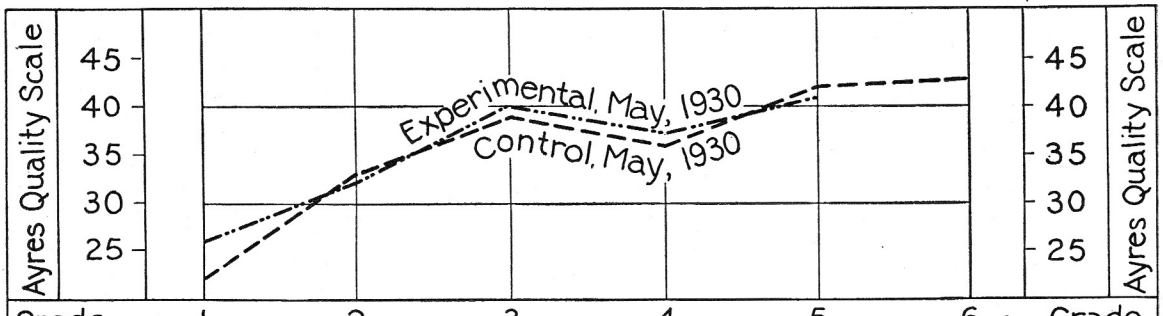
Arithmetic computation, which occupies first place in Chart 4, now takes fifth place, although the excess gain of the Typewriter pupils is still substantial. Geography and language usage, which in the first-year chart occupy second and third places, now take first and second places, with arithmetic reasoning in the third place, having moved up from the ninth place in Chart 4. These shifts are interesting and stimulate speculation, but their importance should not be stressed. In so far as they are manifestations of the influence of the typewriters, they are probably no more than reflections of the particular applications which the Experimental teachers found feasible after only one year of experience with the machines under the somewhat burdensome conditions of the experiment. It is unlikely that the typewriter is inherently less useful in history and civics than in geography, for example. If these differences are due in any measurable degree to the influence of the typewriters, it would seem far more reasonable to suppose that in the schools participating in this experiment, geography of the type measured by the Stanford Achievement Test was wittingly or unwittingly emphasized more than the history and civics measured by the Stanford Achievement Test, and that the typewriter has made its greatest contribution in the subjects most emphasized. The important indication of all the charts thus far presented is that the use of the typewriter seems to be compatible with excess gains in some subjects, and with approximately normal gains in all other subject matters in which we have made separate measurements. In this connection, Dr. Haefner's chapters on the typewriter in relation to the various subject matters will be found illuminating.

Handwriting quality. In May 1931, 1464 children in grades two to six took the handwriting test who had taken a comparable handwriting test in May 1930 when in grades one to five. The lines at the bottom of Chart 13 show that the median quality scores of these 1464 pupils in May 1930 are approximately equal to the median scores of Control pupils in corresponding grades; the lines in the middle of Chart 13 show that in May 1931 the medians of the 1464 two-year Typewriter pupils are approximately equal, on the average, to the medians of Control pupils in corresponding grades.

The lines at the top of Chart 13 show the median quality scores of identical groups of children in May 1930 and in May 1931. The lower line shows medians of the children when they were in grades one to five, and the upper when they were in grades two to six. The average difference between the five pairs of medians is about five Ayres points. This average growth of five Ayres points is, of course, a twelve-month growth. Unfortunately, these gains in handwriting quality cannot be compared with September 1929–May 1930 gains, since, as already indicated in the preceding chapter, the two first-year samples taken were not comparable. However, it is worth noting that the average gain of five points is 25 per cent larger than the average difference between Control grade medians, which is four Ayres points. According to the Ayres scale, four points is the uniform difference between successive grade norms. It thus appears that the second year's use of the typewriters has not prevented an approximately normal growth in handwriting quality. While this comparison is not quite direct, it strengthens the conclusion suggested above, that if the typewriter has had any influence on handwriting quality, it was not negative. There







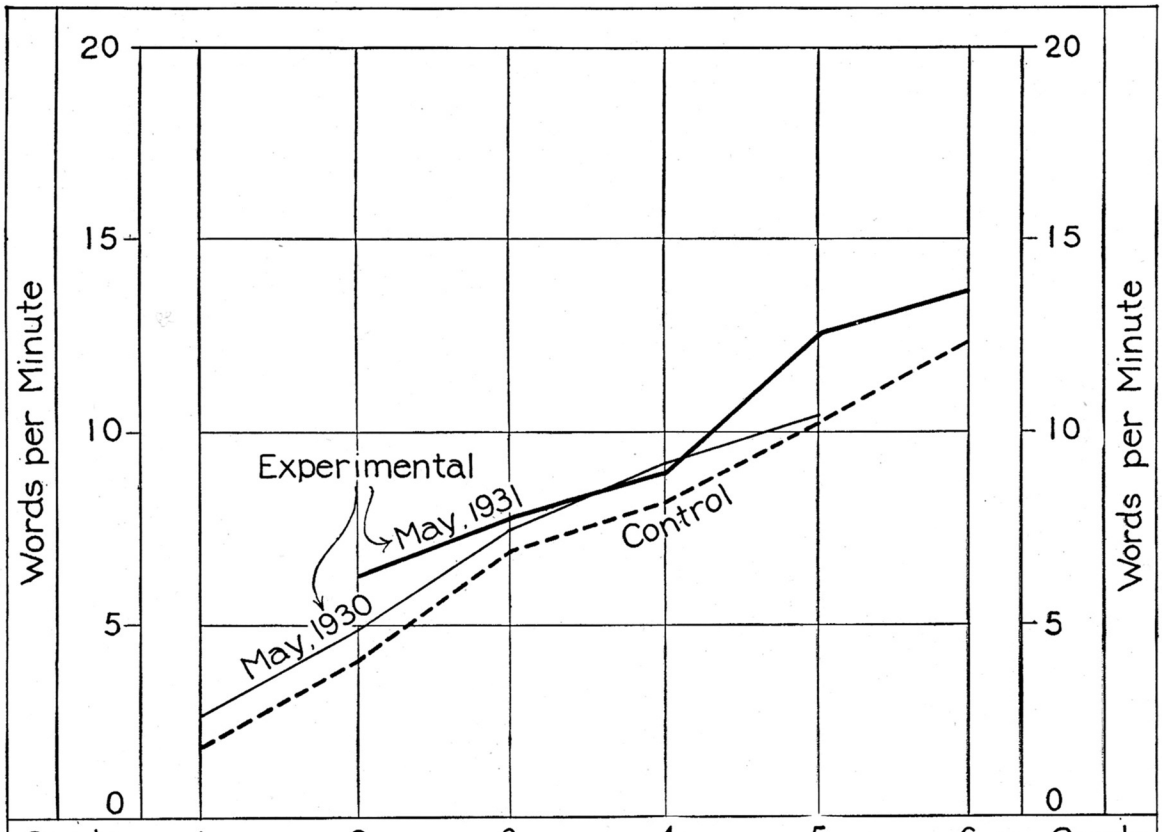
X May '30	281	352	319	261	251		1464
X May '31		281	352	319	261	251	1464
C May '30	866	778	599	585	646	436	3910

CHART 13. HANDWRITING QUALITY OF EXPERIMENTAL PUPILS IN GRADES TWO TO SIX AFTER TWO YEARS OF EXPERIENCE WITH THE CLASSROOM TYPEWRITER

The lines at the bottom show the median quality scores of the two-year Experimental groups in May 1930, when in grades one to five, in relation to the Control medians for May 1930, in grades one to five. The lines in the middle show the May 1931 medians of the two-year Experimental groups, when in grades two to six, in relation with the Control medians for May 1930, in grades two to six. The lines at the top show the May 1930 and May 1931 medians of identical groups of Experimental pupils. The medians are based on returns of all Experimental pupils who had handwriting tests both in May 1930 and May 1931.

is no evidence in any of these charts that the typewriter has exerted a retrogressive influence on handwriting quality.

Handwriting rate. Evidence to the effect that the use of the classroom typewriter effected no loss in handwriting rate in the first year was presented in the preceding chapter (Chart 6, page 40). Chart 14 indicates that the Experimental groups in all grades at the end of the second year are somewhat superior in handwriting rate to the Control groups in corresponding grades. In May 1930 the 1464 two-year Experimental pupils represented in Chart 14 were not quite as superior to the Control pupils as the total group of 2480 Experimental pupils represented in Chart 6. From May 1930 to May 1931, the Typewriter pupils increase their superiority over Control pupils in corresponding grades from an average of less than one word per minute to something over one word per minute. The difference does not seem significant, and our conclusion is that the classroom typewriter has not affected handwriting rate to a significant degree one way or the other.



X May '30	281	352	319	261	251		1464
X May '31		281	352	319	261	251	1464
C May '30	866	778	599	585	646	436	3910

CHART 14. HANDWRITING RATES OF EXPERIMENTAL PUPILS IN GRADES TWO TO SIX AFTER TWO YEARS OF EXPERIENCE WITH THE CLASSROOM TYPEWRITER IN COMPARISON WITH THE EXPERIMENTAL AND THE CONTROL PUPILS AT THE END OF THE FIRST YEAR

Based on returns from the groups described in Chart 13.

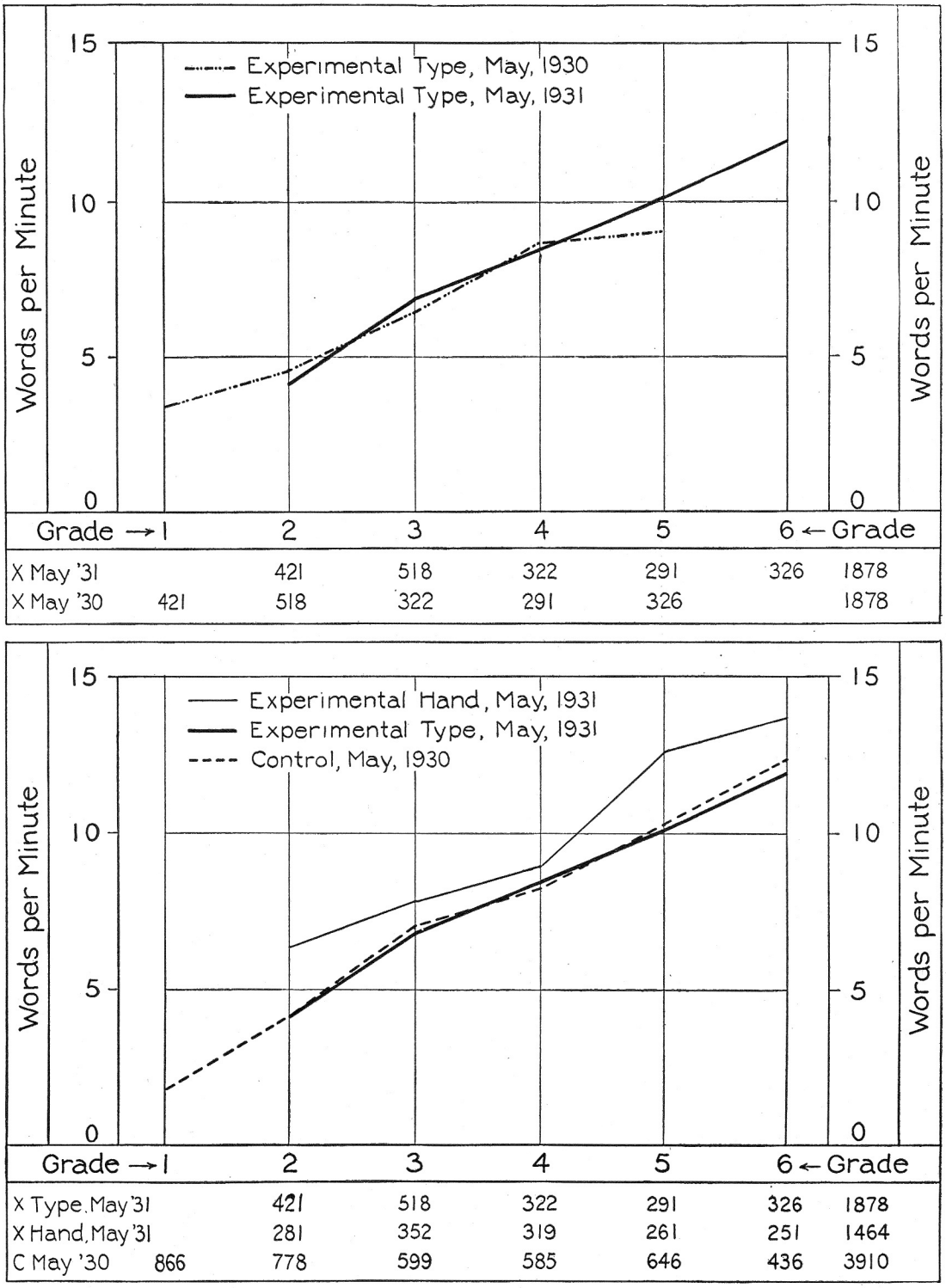


CHART 15. TYPING RATES OF EXPERIMENTAL GROUPS IN GRADES TWO TO SIX AFTER TWO YEARS OF EXPERIENCE WITH THE CLASSROOM TYPEWRITER, COMPARED WITH THEIR OWN TYPING RATES ONE YEAR EARLIER WHEN IN GRADES ONE TO FIVE (UPPER CHART), AND WITH HANDWRITING RATES OF EXPERIMENTAL AND CONTROL GROUPS (LOWER CHART)

The first and second year typing rates are based on returns from all Experimental pupils who took typing rate tests both in May 1930 and May 1931.

Typewriting rate. The lines at the top of Chart 15 show that the median typing rate is about the same at the end of the second year of using the typewriters as at the end of the first year for groups in corresponding grades. This provides the very interesting indication that the Experimental pupils in each grade reach a " grade typing rate limit " during the first year of experience with the classroom typewriter, as used in this experiment.

The lines at the bottom of Chart 15 show that this typing rate limit closely approximates the Control handwriting rate in each grade; and that the typing rate limit of each grade is slightly lower than the handwriting rate of the Experimental pupils after two years of experience with the classroom typewriter as used in this experiment.

Typing error index. Chart 16 indicates that there is also a typing accuracy limit for each grade, that the Typewriter pupils reach this limit during the first year, and do not surpass it in the second year of experience with the classroom typewriter as used in this experiment. Three per cent of errors in the upper grades, and 4 to 6 per cent in the lower grades, seem to be the limits of accuracy reached in the first and not surpassed in the second year of experience with the classroom typewriter as used in this experiment.

Data on the reliability of the typing rate and error tests are shown in the Appendix, Table A11.

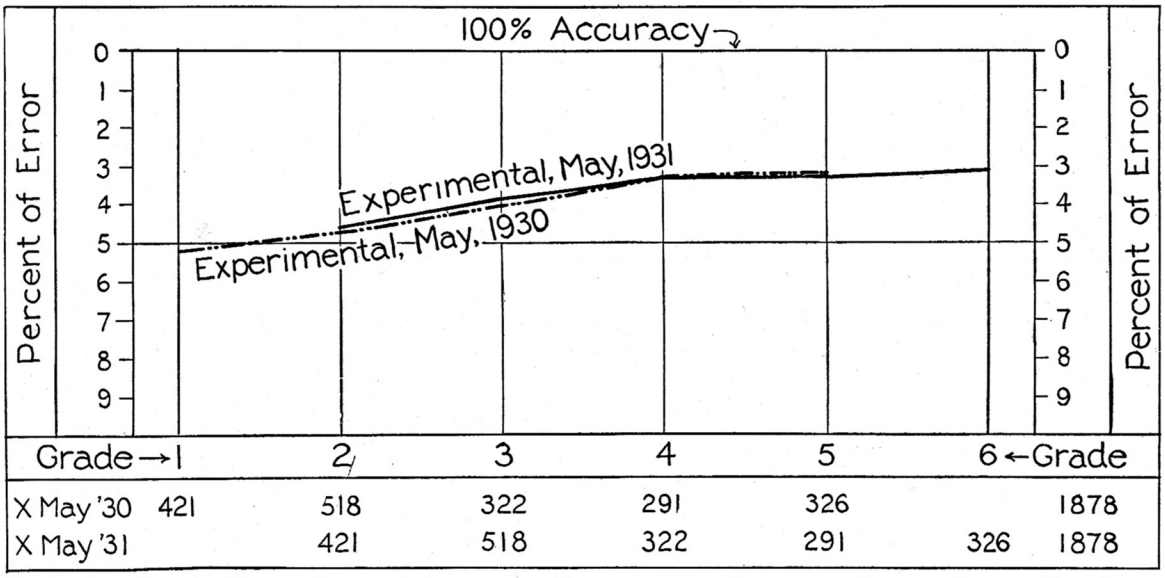


CHART 16. TYPING ERROR INDEX AVERAGES OF EXPERIMENTAL PUPILS IN GRADES ONE TO SIX AFTER ONE AND TWO YEARS OF EXPERIENCE WITH THE CLASSROOM TYPEWRITER, BASED ON RETURNS FROM TWO-YEAR PUPIL GROUPS DESCRIBED IN CHART 15

CHAPTER IV

CHILDREN'S WRITINGS: FIRST YEAR

Introduction

Importance of children's writings. The importance of the quantity, variety, and quality of children's writings in judging the educational values of a new writing device is obvious. Unfortunately, no direct qualitative study of the children's writings has been possible; and the quantitative results presented below are based on returns from only four cities. But this quantitative study is of considerable value, because under normal school circumstances there is scarcely any writing that would be done which is not educationally valuable, and hence the gross quantity of writing done during a given period is at least a fair, though a rough, index of the benefit that children have received from writing during that period. If the use of any device decreased the amount of original composition work, it would certainly be considered unfortunate; on the other hand, any device that increased the original composition efforts of pupils would undoubtedly be considered beneficial, especially in view of the difficulty that most teachers experience in getting their children to practice sufficiently in original written expression.

However, we are not solely dependent upon this assumption, even though we have made no qualitative study of the Experimental and Control writings. In the first place, the test results presented in preceding chapters are consistent with the inference that the quality of the writing done by the Experimental pupils was at least normal. In the second place, a great majority of the Experimental teachers judge that the quality of the written work in their classes was not only equal, but superior in various respects to what it had been in similar classes that had not had the use of the typewriters. (See Chapter VII.) And finally, we shall show presently that quantity of writing is positively correlated with gains on the Gates and Stanford tests.

Collection of children's writings. The directions given to Experimental and Control teachers for saving the children's writings have already been described in Chapter I. It will be recalled that they were first requested to save *all* writings of the children *except* the arithmetic papers, and that about a month after the experiment began this exception was rescinded. The directions to both Experimental and Control teachers were given with the sanction and under the authority of the superintendents of the public schools and of the headmasters of the private schools; and they came to the teachers through the principals. At intervals throughout the experiment, supplementary communications were sent, particularly to the Control teachers, for the purpose of reminding them of the need for care in saving *all* written materials. Since the directions to save arithmetic papers did not reach the teachers until late in October, the collections of arithmetic papers are not complete. However, the directions reached the Experimental and Control teachers at the same time, and it is believed that the first-year collections secured are equally

complete for the Experimental and Control groups, and that the quantitative comparisons made below are valid.

Classification of children's writings. In order to study the influence of the typewriter on the *variety* and *kinds*, as well as upon the *quantity* of writing done by children, an effort was made to classify the written materials into significant categories. The great variety and complexity of the children's writings made the task a difficult one. The most important division was that between original and copied work, but even here we could not always be sure. However, since both Experimental and Control materials were classified according to the same criteria and by the same research assistants, the mistakes made in classification could not seriously favor one group as against the other.

The categories used are shown in the following outline, and the nature of the writings included in each category is indicated by the brief note after each heading.

I. Original Material

S. *Stories.*
This classification was stretched to include all kinds of original compositions, all kinds of original sentences, and occasionally original outlines when they were particularly full and extensive, even though they were not written in sentence form.

L. *Letters.*
Anything in the form of an original letter, even though the subject matter may have included some copied work, was included in this class.

I. *Individual Projects.*
Two kinds of products were considered as projects.
(1) A booklet with a title, and written on a definite subject. Booklets with titles so broad as to include at least one entire branch of our classification were not considered as projects. The booklets usually contained several pieces of writing.
(2) A drawing, diagram, chart, or music notation, with a name or explanatory labels.
Projects have been classified as individual where one person has done all the work, or only two pupils have worked together (in which latter case, the credit has been divided).

G. *Group Projects.*
Projects including work done by more than two pupils have been called group projects. Aside from the number of contributors, a group project in booklet form is like an individual project in booklet form. Other forms which group projects take are:
(1) Class newspapers.
(2) Plays composed by the class.
(3) Any other form of group composition written down once only. If each child has made a copy, the separate pieces have been called copied work.

II. Copied Material

P. *Practice Work,* such as penmanship exercises or efforts to master the mechanics of writing on the typewriter. Formal penmanship was easy to distinguish because of the muscular exercises which regularly appear on the page. Where sentences or paragraphs have been used as purely penmanship exercises, we have been able to recognize them as practice writing by such titles as "writing," or "penmanship" as occasionally appear, by the visible efforts of the child to form his letters better, by the continued repetition of the given sentences or paragraphs — and sometimes by the knowledge that such material is used universally for penmanship (as "Fourscore and seven years" etc.). Where none of these earmarks were available, we have probably erred in classifying such material as II *N*. Where other types of material have been written as many as three times successively in the same piece, we have considered them practice work, too.

A. *Arithmetic.*
Problems, tables, etc. In the lower grades this included counting exercises.

N. *Narrative,* descriptive, and expository material, copied from any source.
This classification was stretched to include all kinds of copied compositions and sentences. In the lower grades, of course, all work might be counted as penmanship practice; but where copied work, in these grades, was legible and where it occurred fewer than three times consecutively, we have included it in this category.

L. *All kinds of lists*, consisting of words or phrases. Lists of complete sentences were not included in this classification. (In the charts presented below, the last two classifications are merged and called "copied writings.")

These brief descriptions of the kinds of writings included in each classification should be kept in mind when studying the comparisons which are made in this and the succeeding chapter.

Determining the length of written pieces. The magnitude of the task of classifying, and more especially of determining the length or number of words in each piece of the children's writings, explains why, with the time and means at our disposal, we have been able thus far to analyze the written collections from only four cities. The total number of pieces of writing from the four cities classified and counted was over 578,000. In addition, a rough study was made of kindergarten pieces from two other cities.

Obviously, the words in so many pieces of writing could not be actually counted, nor would an actual count be necessary for our purposes. Actual counts were made of all papers written in the form of lists, all arithmetic papers, and all unruled handwritten papers; but for all others scales were made up for each category of writing, and for each size of paper for handwritten and typewritten pieces, using actual samples from the collections. The scales were checked by actually counting the words in several hundred pieces in each category, and comparing these counts with the results obtained by the scales. The differences found were negligible. In any event, since the Experimental and Control handwritten pieces were counted with the same scales and by the same research assistants, the results cannot be seriously unfair to either group. The scales for the typewritten pieces gave highly accurate results, as the greater clarity of the typing would lead one to expect.

Assembling the counts. After the pieces in a given student's folder had been classified and scaled for length, each piece was tallied in its appropriate cell on a "Pupil's Summary Sheet," the general form of which is indicated on the following page. The corresponding form for Control pupils included only the left half of the form shown, that marked "Handwritten."

When all the pupils' summary sheets were ready, they were assembled on a "Grade Summary Sheet" of the same general form. The results of the long process of classifying and scaling the length of the pieces of writing done by 2689 children in four cities in 1929–30 were thus assembled on twelve sheets, one for each grade of Control and one for each grade of Experimental children.

In order to secure a rough indication of the *typical length* of pieces in each category, the median was calculated for each column in each grade summary sheet. The product of each median multiplied by the number of papers has been taken as a rough index of the total number of words written in each category. The quotient of this figure divided by the number of pupils has been taken as a rough index of the number of words written per pupil in each category of writing. All the comparisons that follow are based upon these rough indices of length of pieces and of quantity of writing done per pupil; hence, their statistical limitations should be kept in mind. It is hoped that more adequate statistical treatment of these interesting data may be made in later studies. In the meantime, the comparisons made below may be accepted as statistically unbiased, since the distributions of Experimental and Control writings according to length were closely similar, as would be expected.

Name _____ City _____

Grade _____ Number of Pupils _____ State _____

School _____ Year _____

	HANDWRITTEN										TYPEWRITTEN										TOTAL
	Original				Copied					Total	Original				Copied					Total	
	Stories	Letters	Individual Projects	Total	Practice	Arithmetic	Narrative	Lists	Total		Stories	Letters	Individual Projects	Total	Practice	Arithmetic	Narrative	Lists	Total		
500-																					
300-499																					
200-299																					
150-199																					
100-149																					
75-99																					
60-74																					
50-59																					
40-49																					
30-39																					
20-29																					
10-19																					
0-9																					
Number of Pieces																					
Median Length																					
Median Length x No. of Pieces																					

PUPIL'S SUMMARY SHEET

This form was used in analyzing the children's writings as described in the text. The scale at the left is in terms of words per piece.

Intelligence and Achievement Standing of the Experimental and Control Groups

Numbers of cases. All of the comparisons in this chapter, except those concerned with kindergartners, are based upon the writings during the school session 1929–30 of 1276 Experimental and 1413 Control children in four cities. These numbers comprise all of the Experimental children in the four cities, all of the Control children in two cities, and random halves of the Control children in the other two cities. The grade distributions of these two groups of children are shown in Table 4.

TABLE 4

Numbers, Median Mental Ages, and Median Initial Achievement Test Scores of Experimental and Control Pupils in Each Grade Whose Writings during the First Year of the Experiment Are Described in Chapter IV

Grades	Numbers of Children		Median Mental Age in Years and Months		Median Achievement Test Standing in Grade Units	
	X	C	X	C	X	C
1	193	194	6– 6	6– 6	1.2	1.3
2	215	310	7–11	8– 0	1.8	2.2
3	242	208	8– 9	9– 0	2.8	3.1
4	210	225	9–10	9–11	4.1	4.3
5	212	225	10– 9	11– 0	4.8	5.1
6	204	251	11–11	12– 2	6.3	5.9
Totals . . .	1276	1413				

Control groups are slightly superior. In order to attribute any differences in quantity of writing done by the Experimental and Control groups to the influence of the classroom typewriter, it must be shown that the two groups are equal in all significant respects, except that the Experimental group had the use of the typewriters. If any significant differences are found between the two groups, reasonable allowance must be made for them.

The curriculum of the Experimental and Control groups was the same for the Experimental and Control groups in each of the four cities. According to the available service records and supervisors' ratings, the Experimental and Control teachers in these four cities stand approximately in the same relation to each other as in the six cities, as a comparison of the following figures with those of Table 3 will show. The fact that both Experimental and Control teachers in the four cities receive lower average ratings from their supervisors probably indicates nothing more than a small difference in rating standards between the supervisors in these four cities and in the other two of the six cities of Table 3.

	Experimental Averages	Control Averages
Years of experience . . .	11.4	13.18
Years of local tenure . .	7.26	9.29
Semesters of college training	4.19	4.53
Number of summer sessions attended	.83	1.11
Number of teachers for whom data are available.	36	73
Supervisors' ratings . . .	2.17	2.47
Number of teachers rated .	30	62

In order to compare the learning capacities of the Experimental and Control groups, their median intelligence scores and median

PLATE 4. THE STUDY PERIOD IN A THIRD-GRADE CLASSROOM
All the typewriters in the room are in use.

initial achievement test scores have been computed, and transmuted into mental age and grade units, with the results shown in Table 4.

These figures show that the Control groups have a slight advantage in mental age in all grades except the first, and a measurable advantage in initial achievement in all grades except the sixth.

The differences are not excessively large, but they are large enough to constitute a small but definite handicap to the Experimental groups. This advantage of the Control groups should be kept in mind in the comparisons made in the following pages between the writing productivities of the Experimental and Control groups.

Quantity of Writing Done by Experimental and Control Children in 1929–30

At the beginning of the experiment there was considerable and sometimes anxious speculation as to the effect the classroom typewriter would have on the amount of various kinds of writing that would be done by the children in the several grades from the kindergarten through the sixth grade. Would the task of learning a new system of writing decrease the total amount of writing of all kinds? Or would it increase the practice writing at the expense of original composition work? Or would the new system be learned so quickly that the amount of writing of all sorts would be increased, including not only practice writing, and the writing of the various kinds of drill exercises characteristic of the elementary school, but also original composition? The comparisons that follow indicate that the answer to this latter question is in the affirmative.

Quantity of total writings. Chart 17 shows graphically the quantity of writing of all kinds done by the Experimental and Control children in grades one to six during the school session 1929–30. It is clear from this chart that the Experimental children write considerably more than the Control children in every grade. The amount of writing done by the Experimental children in grades one and two is notably greater than that done by the Control children. In these two grades, the Experimental children are more productive than the Control in the amount of handwritten work alone. In grade one the Experimental children average a total of over 3000 words per pupil, and nearly 1500 handwritten words per pupil, while the Control children average less than 500 words per pupil. In grade two the Experimental children average a total of more than 5500 words, of which over 3000 are handwritten, while the Control children average a total of only slightly more than 2500 words per pupil during one full school year.

Thus it appears that the typewriter, far from competing with, has actually stimulated handwriting in grades one and two. If confirmed by further experimental evidence, the importance of this indication regarding the influence of the classroom typewriter on the quantity of writing done by beginners, both by hand and machine, can hardly be overestimated.

In grades three and four the handwritten work of the Experimental children is slightly less, and in grades five and six measurably less, than the total output of the Control children, all of which was, of course, handwritten. However, the amount of handwriting done by the Experimental children in these grades is still quite substantial, and their total writing, by hand and machine, is measurably greater than the total done by the Control children. The slightly smaller amount of handwritten work by the Experimental children thus involves no loss in total writing experience, and probably represents a wholesome release from sole dependence

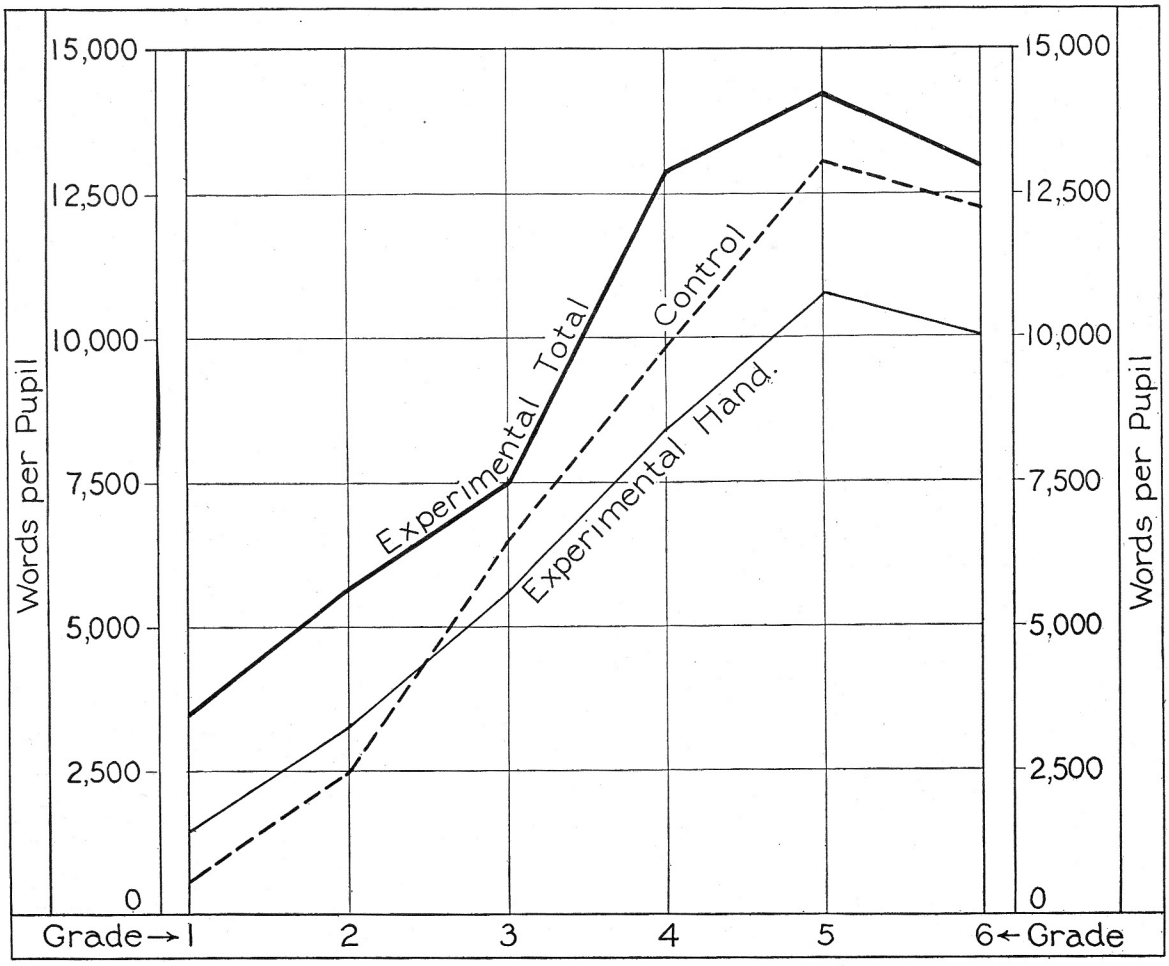


CHART 17. QUANTITY OF WRITING DONE BY EXPERIMENTAL AND CONTROL CHILDREN IN EACH GRADE, IN TERMS OF TOTAL WORDS WRITTEN PER PUPIL DURING THE SCHOOL SESSION 1929–30

The points connected by the heavy solid line indicate the numbers of words written per pupil by hand and on the typewriter in each grade by the Typewriter children; the light solid line connects points indicating numbers of words handwritten by Typewriter pupils; the distance between these two lines indicates the typewritten words per pupil in each grade. The points connected by the dash line indicate words per pupil written by Control children in each grade.

on crayon, pencil, and pen. This interpretation is not only consistent with their greater total output, but is specifically suggested by the testimony both of teachers and of pupils. (See Chapters VI, VII, and IX below.)

Incidentally, Chart 17 also shows the typewritten output per pupil of the Experimental children. The average number of words typewritten per pupil during the year in each grade is indicated by the difference between the points connected by the heavy and light solid lines. For example, in grade one the Experimental children averaged 3400 words per pupil, of which 1400 were handwritten; hence they averaged 2000 typed words per pupil during the first year in which they used the machines.

Relative influence of teachers' ratings and of typewriters on quantity of writing. Since, as shown above on page 60, the Experimental teachers involved in the comparisons

just made received a more favorable average rating from the supervisors than the Control teachers, it is quite possible that the excess of Experimental over Control written output during the first eight months of using the classroom typewriter is attributable to the superiority of the Experimental teachers rather than to the use of the typewriters. This question has been studied in the manner suggested by Professor Kelley, already described above on page 30.

The partial correlations indicate that the writing activity of the pupils is much more closely related to the use of the typewriters than to the ratings of the teachers, except in grades two and three, in which the influences of teachers and of typewriters are approximately equal. The correlations are shown in detail in Table A13, but their significant indications are summarized in the following partials, those in the left column showing the correlation between output and ratings with influence of typewriters held constant, and those at the right showing the correlation between written output and presence of typewriters, with the teachers' ratings held constant:

Grade	$r_{12.3}$	$r_{13.2}$
1	.05 ± .19	.82 ± .07
2	.75 ± .08	.65 ± .11
3	.35 ± .16	.45 ± .14
4	− .27 ± .19	.52 ± .15
5 and 6	.11 ± .12	.28 ± .11

It seems clear from these relationships that the greater writing activity of the Experimental pupils can be attributed in a substantial degree to the presence of the classroom typewriters, and only in a minor degree to the superiority of the Experimental teachers. Only in grades two and three do the partials suggest any measurable influence of teachers' ratings on writing activity, and here the indication is that they are approximately as potent as the typewriters. The dependence of written output on the presence of the typewriters in grade one is especially significant, because it is in the early stages of school work that the disadvantages and limitations of handwriting as a means of written expression have been most often observed.

Correlation between quantity of writing and test gains. Correlations between average class gains on the Gates and Stanford Achievement tests and class averages of words written per pupil have been calculated for all Experimental and Control classes in each grade for which data are available. The correlations are positive in all grades, ranging from 0.20 to 0.49. These relationships suggest that writing is compatible with and probably in some degree contributory to gains of the types measured by the Gates and Stanford tests. While these data do not give grounds for any confident estimate of the nature and extent of the influence of writing on test gains, it seems clear that they offer no evidence that an increase in quantity of writing tends to reduce educational progress as measured by the Gates and Stanford tests.

The correlations of quantity of writing with gains in several parts of the Stanford test indicate that quantity of writing is more closely related to gains in some subjects than in others. The highest of these correlations is with spelling gains, the average for grades four, five, and six being 0.40. The other correlations which we have calculated for sub-test gains are not statistically significant. (See Table A19.)

Quantity of original writing. The influence of the typewriter on the amount of original composition work done by the children is of crucial importance. The greater written output of the Experimental groups shown in Chart 17 may be desirable in itself in all grades, and is almost certainly de-

sirable in the early grades; but if this greater output represents only more practice writing, especially if at the expense of original composition work, its educational value might be questionable. But if, instead of increasing the practice load of the children, the typewriters tended to release the self-expression of the pupils, and to give them a more effective means of carrying out their creative impulses, the whole matter is in another light.

Chart 18 shows that the quantity of original writing of the Experimental children exceeds that of the Control children by a large margin. This is notably the case in the early grades. In grades one and two, the Control children did almost no writing that could be classified as original. Indeed, as may be seen in Chart 17, the Control children in grade one did almost no writing of any sort — less than 500 words per pupil — and Chart 13 shows that only a small fraction of this could be classified as original. By contrast, the first-grade Experimental children averaged a total of 3400 words per pupil, and about 300 words per pupil of original composition. In grades two and three the Experimental children averaged respectively about 1000 and 1400 words of original composition per pupil, while the Control averaged about 50 and 900 words per pupil. In grades one, two, and three, the handwritten output of original writing of the Experimental children exceeds the

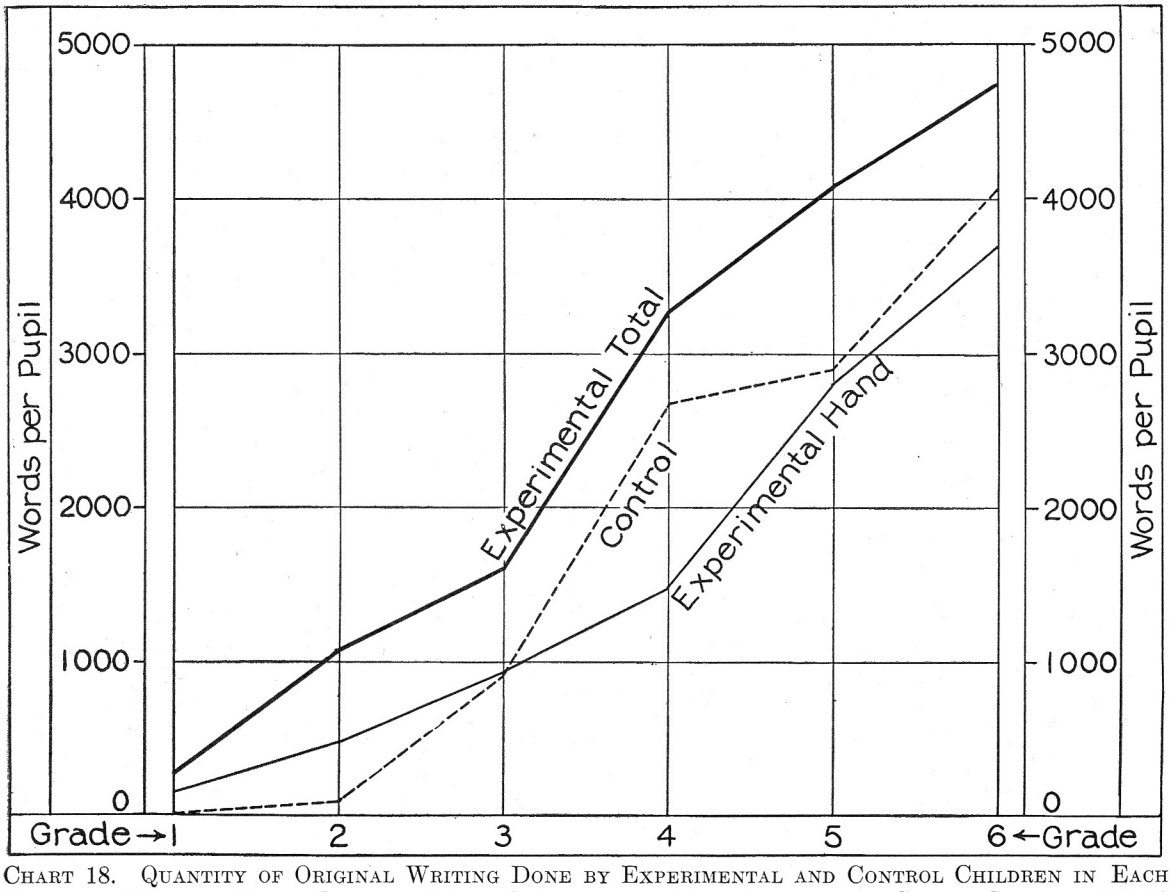


CHART 18. QUANTITY OF ORIGINAL WRITING DONE BY EXPERIMENTAL AND CONTROL CHILDREN IN EACH GRADE IN TERMS OF TOTAL ORIGINAL WORDS WRITTEN PER PUPIL DURING THE SCHOOL SESSION 1929–30

This chart is parallel to Chart 17 and is read in the same manner.

total output of original writing of the Control children.

The classroom typewriter appears not only to have increased the total original work in all grades, most notably in the early grades, but it appears to have increased the handwritten original work in the early grades, and not to have seriously lessened the quantity of handwritten original work in the intermediate grades.

Quantity of practice writing. Chart 19 indicates that the typewriter not only did not increase the amount of what has been classified as practice writing done by the Experimental children, except in grade one, but apparently effected a measurable decrease in the upper grades. Nearly all of the practice writing done by the Experimental children was in handwriting. The small amount of practice writing on the typewriter indicated in Chart 19 is an important, and we believe fairly accurate, indication of the small amount of sheer practice on the typewriter which the children found necessary.

Incidentally, the relatively large amount of practice handwriting done by the Control children in the upper grades suggests a question of fundamental educational policy. Is so much handwriting practice really necessary? Would not less handwriting practice probably be more effective? The Experi-

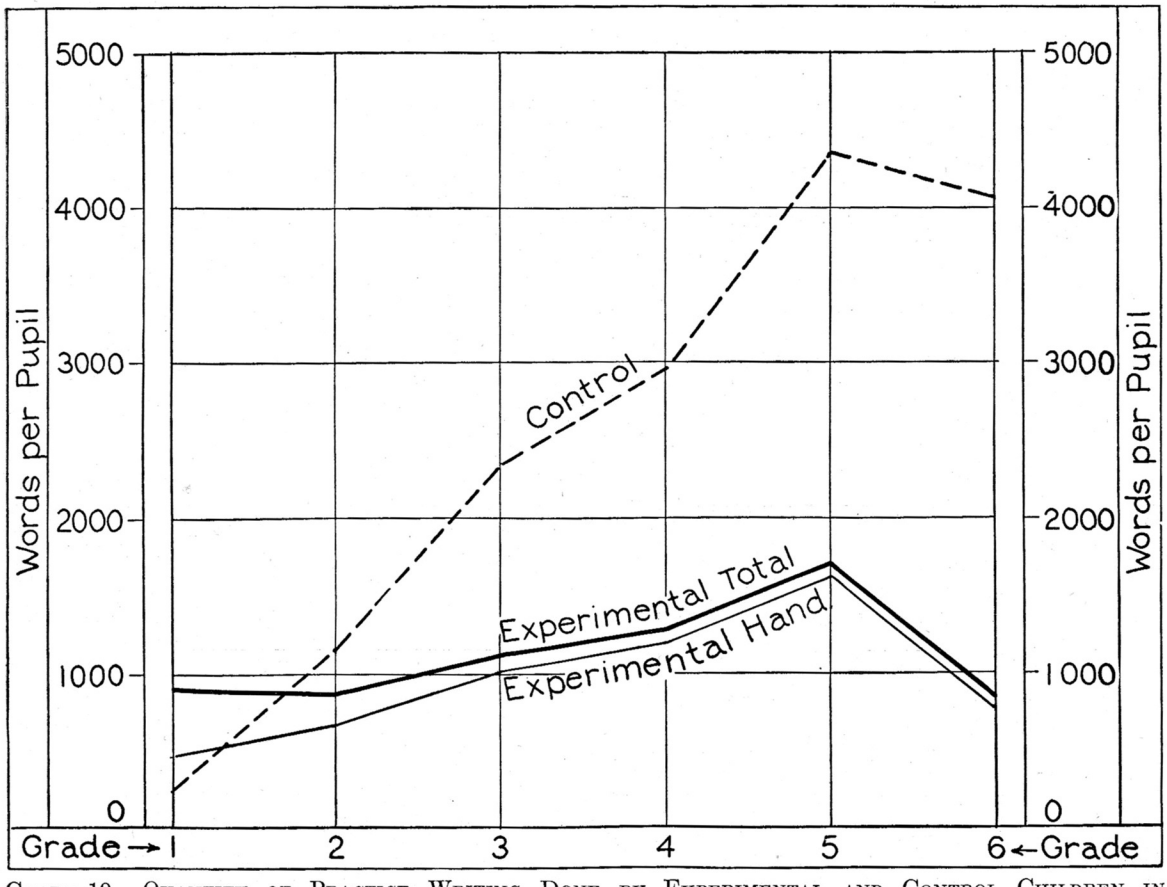


CHART 19. QUANTITY OF PRACTICE WRITING DONE BY EXPERIMENTAL AND CONTROL CHILDREN IN EACH GRADE IN TERMS OF TOTAL PRACTICE WORDS WRITTEN PER PUPIL DURING THE SCHOOL SESSION 1929–30

This chart is parallel to Chart 17 and is read in the same manner.

mental children in the upper grades seem to have gotten along in a way satisfactory to their teachers and without loss in handwriting quality with only about one-third as much handwriting practice.

The question just mentioned suggests the need for further detailed researches. It is clear from Chart 19, however, that the classroom typewriter has not increased the practice burden of the children.

Quantity of copied writing. Chart 20 shows that the Experimental children in all grades copied more prose and poetry, and more lists of words, phrases, sentences, and other similar drill and exercise materials, than the Control children. Taking all grades together, the Experimental children wrote nearly twice as much of such instructional materials as the Control children did. The handwritten work alone of the Experimental children equals or exceeds in quantity that done by the Control children in all grades.

In grade one about two-thirds of the copied work was done on the typewriter; in grade two over one-half of the copied work was done on the typewriter; and in grades three to six about one-third was done on the typewriter. These relations are shown by the distances between the points connected by the heavy solid lines, which show total words written per pupil, and the points connected by the light solid lines, which show words handwritten per pupil.

While the indications of Charts 19 and 20 seem to have some significance, they should not be accepted without reservations. Great care was exercised in classifying the children's writings, and the same research assistants, using the same classification rules, did the classifying work for both Experimental and Control writings, so that

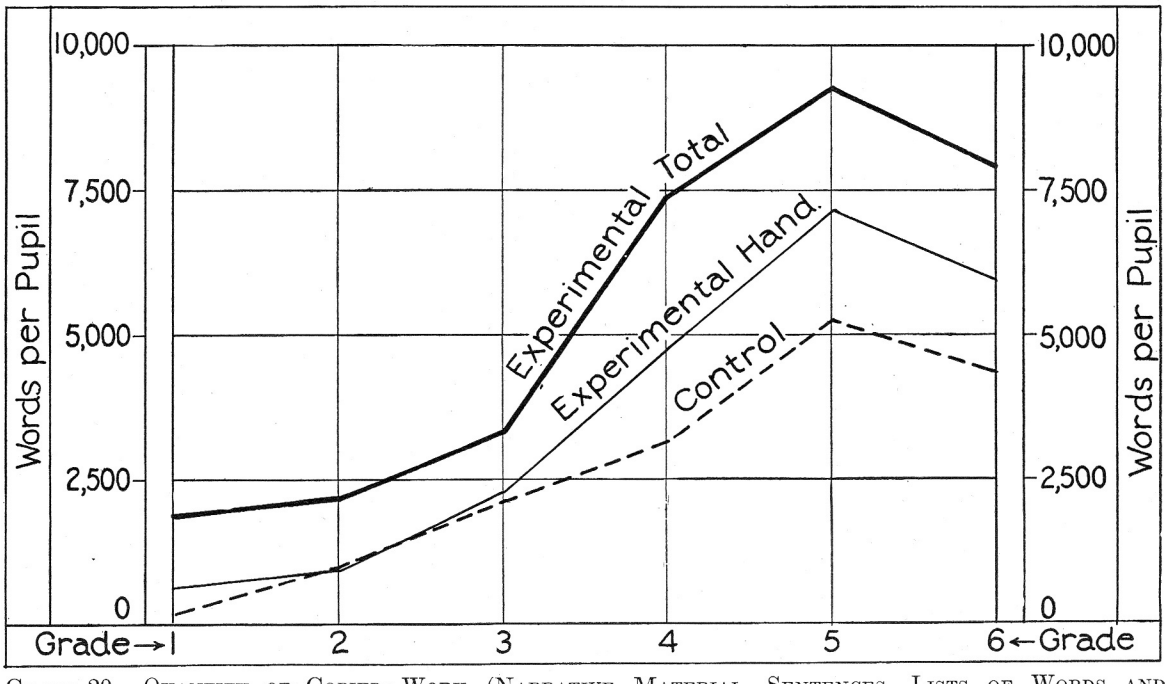


CHART 20. QUANTITY OF COPIED WORK (NARRATIVE MATERIAL, SENTENCES, LISTS OF WORDS AND PHRASES, ETC.) WRITTEN BY EXPERIMENTAL AND CONTROL CHILDREN IN EACH GRADE IN TERMS OF TOTAL WORDS COPIED PER PUPIL DURING THE SCHOOL SESSION 1929–30

This chart is parallel to Chart 17 and is read in the same manner. "Copied work" here means all writings classified as "narrative" or as "lists" according to the outline presented above on page 57.

the chance for bias in favor of one or the other group was quite small. However, the difficulties of classification mentioned earlier in this chapter should be kept in mind; and, more important still, it is merely a reasonable inference and not an accepted fact that the "copied writings" of Chart 20 are educationally more valuable, all things considered, than the "practice writings" of Chart 19. Even if the inference is accepted at face value, it is not clear that the excess of educational value of the "copied writings" is large enough to be significant. It was noticed that many of the Control papers which were labeled "handwriting," and which were classified as handwriting practice, included content of intrinsic value. It is reasonable to suppose that much of the content value of this writing survived the "practice attitude" and the preoccupation of the pupils with the formation of the letters. If the classifications represented by Charts 19 and 20 are merged, the quantities of writing done by the Experimental and Control groups are approximately equal in each grade.

Quantity of arithmetic writing. Chart 21 shows that the quantity of writing in the field of arithmetic done by the Experimental pupils was greater in grades one and two than that done by the Control pupils. In the other grades the Experimental and Control arithmetic writings were about equal in quantity. Except in grades one and two the quantity of arithmetic writing done on the typewriter was very small in relation to the total quantity.

From the large excess gain of the Experimental group in arithmetic computation as described in Chapter II, it would appear that if that excess gain was causally associated with the use of the typewriter, the significant factor is not to be found in the quantity of arithmetic writing done, but in the quality of the mental processes and in the attitudes of the Experimental pupils while doing their arithmetic work. It is possible that the mere presence of the digits in proper sequence on the keyboard may have had considerable effect, probably largely unconscious, in clarifying the number relations in the minds of many of the stu-

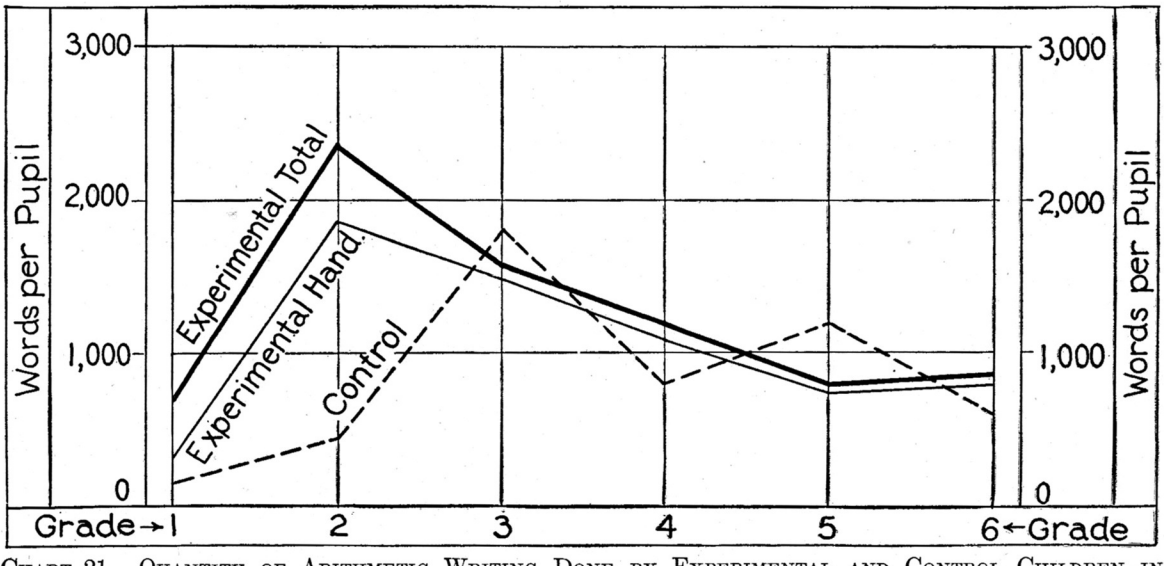


CHART 21. QUANTITY OF ARITHMETIC WRITING DONE BY EXPERIMENTAL AND CONTROL CHILDREN IN EACH GRADE IN TERMS OF TOTAL WORDS WRITTEN PER PUPIL DURING THE SCHOOL SESSION 1929–30

This chart is parallel to Chart 17 and is read in the same manner.

dents. As will be seen in Chapters VI and VII several teachers in the early grades comment on the contribution of the typewriter in giving the children clear images of the numbers and in impressing upon them the necessity for placing numerals in the proper decimal column. It is possible that there was a similar effect in the intermediate grades in which the excess gains reported in Chapter II occur. Another possible explanation is the fact that a large part of the typed arithmetic writing in the upper grades consisted of long lists of original problems made up by the students.

Number and Length of Pieces Written by Experimental and Control Children

Importance of length. The comparison of the average lengths of pieces written by the Experimental and Control children seems important because it may throw some light on the influence of the classroom typewriter on the writing attitudes and habits of students. Other things being equal, the average length of written projects may be considered as a rough index of the educational value of the writing and of the attitude and persistence of the writers.

Numbers of pieces written by Experimental and Control children. Before presenting the data on length, it seems desirable to indicate the numbers of pieces written per pupil in the Experimental and Control groups. The number as well as the length of writing projects which pupils undertake may be considered as a rough index of their attitude toward writing. Chart 22 summarizes the facts.

The lines at the top of Chart 22 relate to all the writings done by the children, and those at the bottom of the chart refer only to the original writings. The lines at the top of the chart show that the total number of pieces of writing done by the Experimental children exceeded the number done by the Control pupils in every grade. The largest differences are in grades one and two. In grade one the number of pieces handwritten by the Experimental children exceeds the total number written by the Control pupils. In all other grades the Experimental pupils write fewer pieces by hand than the total number of pieces written by the Control pupils.

The lines at the bottom of the chart show that the number of original pieces written by the Experimental children exceeds the number of original pieces written by the Control pupils in each grade. The excess of Experimental over Control in number of pieces written per pupil is notably large in grades one and two. Counting only handwritten pieces the Experimental children in grades one and two write several times as many pieces as the Control pupils in these same grades.

This chart shows that the typewriter, as used in this experiment during the first year, played a large part in the original composition work of the Experimental children in all grades. In the first four grades about one-half of the original pieces produced by the Experimental children are written on the typewriter; and in grades five and six between a fourth and a third of the original pieces are written on the typewriter.

Probable errors of differences between Experimental and Control groups. Probable errors of differences between average numbers of pieces written per pupil by Experimental and Control groups have been calculated by the formula

$$\text{P.E.}_{(M_x - M_c)} = .6745 \sqrt{\frac{\text{S.D.}^2_x}{N_x} + \frac{\text{S.D.}^2_c}{N_c}}$$

in which M_x and M_c are the Experimental and Control means of class means, and in which the numerators under the radical are the sigmas squared of the distributions of the Experimental and Control class means, and the denominators are the num-

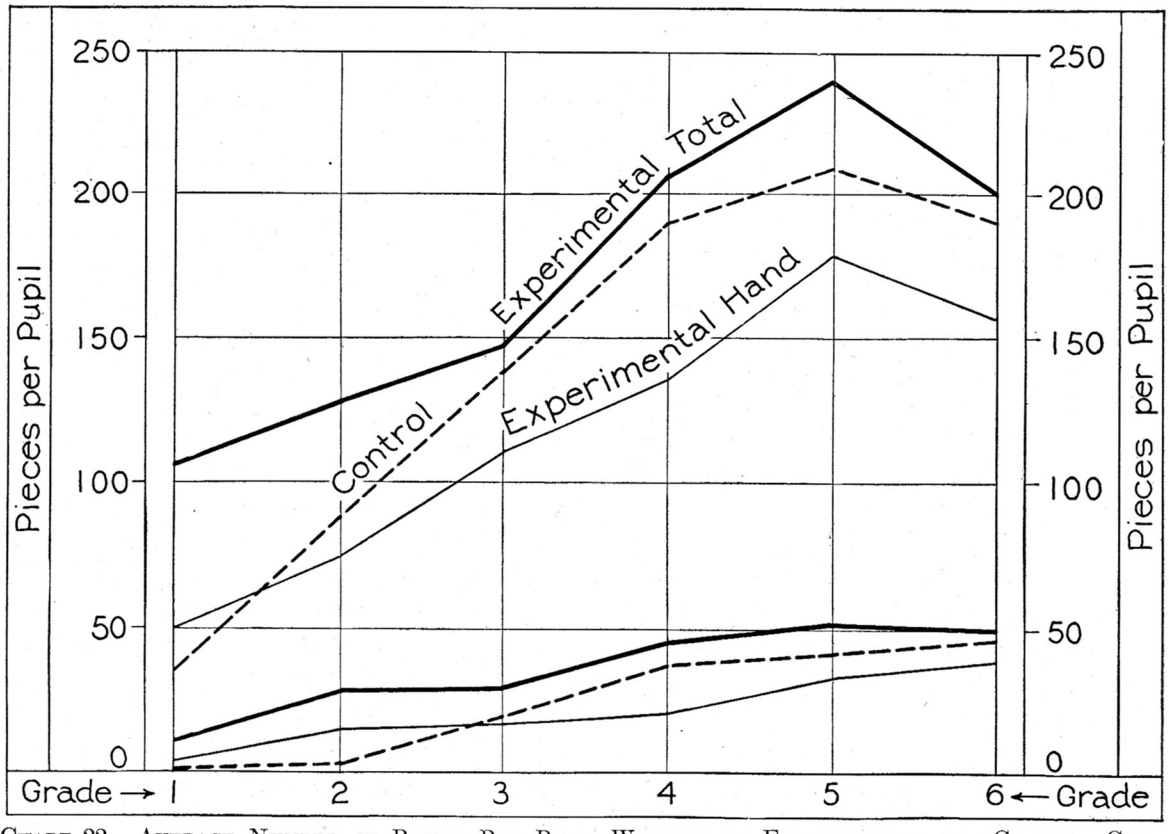


CHART 22. AVERAGE NUMBER OF PIECES PER PUPIL WRITTEN BY EXPERIMENTAL AND CONTROL CHILDREN IN EACH GRADE IN 1929–30

At the top of the chart, the points connected by the heavy solid line indicate the total per-pupil output of pieces of all kinds written by Experimental children, and those connected by the light solid line indicate the per-pupil output of handwritten pieces; the points connected by the dash line indicate the average number of pieces of all kinds written by Control pupils in each grade. The lines at the bottom of the chart show corresponding facts for original composition pieces only.

bers of Experimental and Control classes. We are indebted to Professor Kelley for pointing out the need for taking classes instead of pupils as units. The detailed figures are presented in Table A16 in the Appendix.

In grade one the difference in favor of the Experimental pupils as to average number of total pieces written is more than four times as large as the probable error of the difference; in grades two and five the differences in favor of the Experimental pupils are 2.4 and 2.3 times their probable errors; in grades three and six the differences in favor of the Experimental pupils are 1.2 and 1.8 times their probable errors; and in grade four the difference in favor of the Control pupils is 0.9 of its probable error. The average of the six grade differences is about 1.4 times as large as the average of their probable errors. The differences are undoubtedly significant, but they do not indicate any very strong tendency in favor of the Typewriter pupils, except in grades one and two.

The differences in favor of Experimental pupils as to average number of original pieces written in grades one to six are, on the average, about twice as great as the average of their probable errors. In grades

one, two, and five, the differences are 2.3, 3.6, and 2.7 times as large as their probable errors. On the whole these differences as to original writings seem more significant than the differences as to total writings, except in grades one and two, in which both sets of differences are highly significant.

Median length of all pieces. Chart 23 shows that the pieces written by the Experimental children are longer than those written by the Control children in every grade except the fifth. In grades one and two the typewritten pieces are roughly twice as long as pieces written by the Control pupils. In the first four grades the pieces handwritten by the Experimental children are longer than those written by the Control pupils in these grades, especially in grades one and two. Apparently the tendency developed by the typewriter to treat topics once undertaken more fully carries over in grades one and two to the handwritten projects of the Experimental pupils. The average lengths of the handwritten and of the typewritten pieces of the Experimental children are roughly equal in all grades except the first.

In grades one and two, the differences in median length in favor of the Experimental groups are very significant, both educationally and statistically. In grade one the difference is more than ten times its probable error, and in grade two it is 4.4 times as large as its probable error. In grade three the difference is 1.6, and in grade four 1.3 times the probable error. In the upper grades, however, the differences are insignificant.

Median lengths of original and copied pieces. Chart 24 shows that the original pieces, both typed and handwritten, of the Experimental children are longer than those of the Control pupils in every grade, except the fourth. In all grades except the first, however, the differences in length are very small. The pieces copied by the Experimental children are longer than those copied by the Control pupils in every grade, except the fifth; and in grades one and two they are roughly twice as long. In the upper

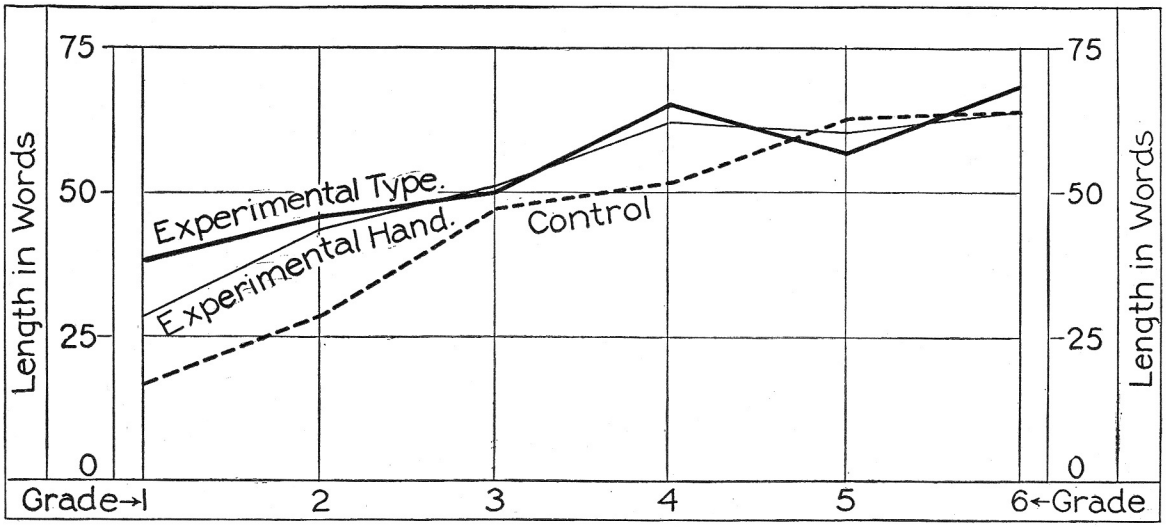


CHART 23. MEDIAN LENGTH IN WORDS OF ALL PIECES WRITTEN BY EXPERIMENTAL AND CONTROL PUPILS IN EACH GRADE IN 1929–30

The points connected by the heavy solid line indicate the average words per piece typewritten, and those connected by the light solid line indicate the average words per piece handwritten by the Experimental children; the points connected by the dash line indicate the average length of pieces written by Control pupils.

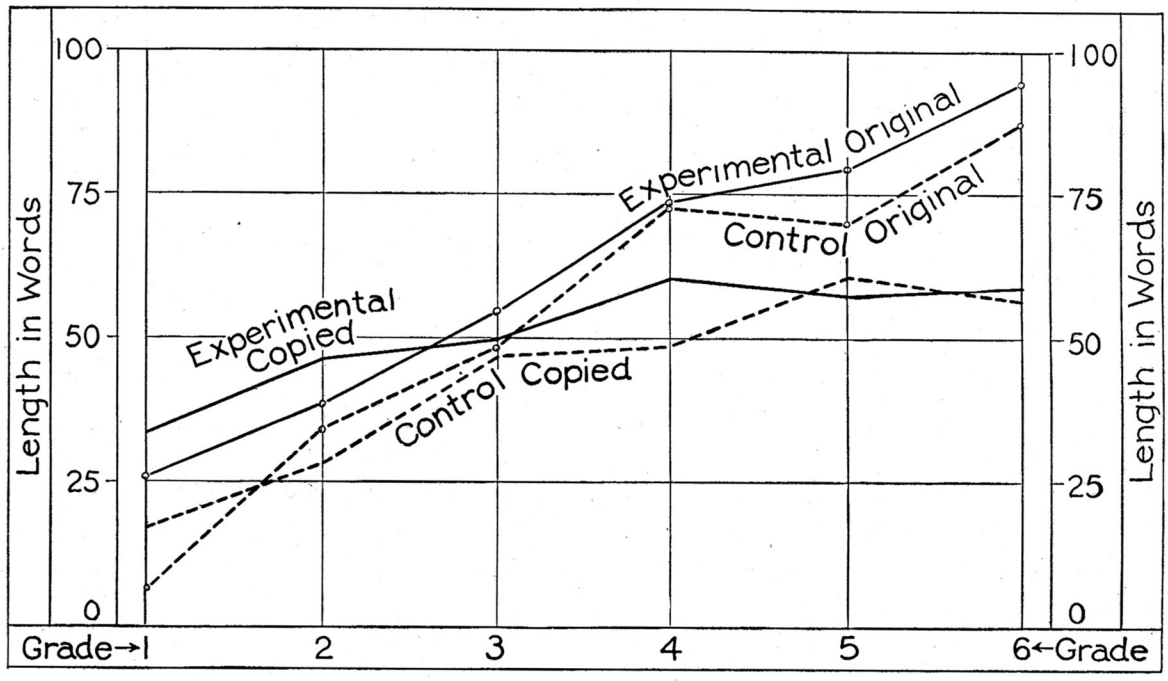


CHART 24. MEDIAN LENGTH OF ORIGINAL AND OF COPIED PIECES WRITTEN BY EXPERIMENTAL AND CONTROL PUPILS IN EACH GRADE IN 1929–30

The points connected by solid lines represent average lengths of Experimental pieces, and those connected by dash lines represent average lengths of Control pieces; the encircled points represent average length of original writings; other points represent average length of copied pieces.

grades the original pieces of both Experimental and Control groups are longer than their copied pieces; in grades one and two the Experimental copied pieces are longer than the Experimental original pieces, and in grade one the Control copied pieces are longer than the Control original pieces. On the whole, the differences do not seem significant, except possibly in grade one.

Considering Charts 22, 23, and 24 together, it appears that the Typewriter children in the early grades attempt a greater number of both original and copied writing projects than the Control children, and carry these undertakings further. The differences in the upper grades are in favor of the Experimental groups, but are hardly large enough to be significant.

Numbers of very long pieces. As an additional indication of the influence of the classroom typewriter on the length of original compositions, the numbers of pieces exceeding 300 words in length written by the Experimental and Control groups have been ascertained. In order to preserve comparability the numbers have been reduced to the common base of 100 students. There were no Control pieces exceeding 300 words in length in the first three grades, and only two or three written by Experimental pupils. The numbers of Experimental and Control papers of 300 words or more per hundred pupils in grades four, five, and six are as follows:

GRADE	4	5	6
Total Experimental original pieces	45	46	159
Total Control original pieces	31	28	106
Experimental handwritten original pieces	3	28	128

It is apparent that the number of very long papers written by the Experimental pupils in each grade was roughly 50 per cent greater than the number written by Control pupils. Of the 45 written by Experimental pupils in grade four, all but three were typewritten; in grade five, 18 of 46 were typed; and in grade six, only 31 of 159, roughly one-fifth, were typewritten.

The number of typewriters was too small to permit the prolific fifth and sixth graders to write a majority of their long pieces on the machines; but there were apparently enough machines to give them better criteria of length for their handwritten projects. In grade five the Experimental pupils wrote by hand as many papers longer than 300 words as the Control, and in grade six they wrote by hand a larger number by 20 per cent than the Control pupils.

Kindergarten Writings

The kindergarten teachers in sixteen Experimental schools in five cities saved all the writings done by 589 kindergarten children in 1929–30. The kindergarten teachers in the Control schools found it difficult to save their pupils' writings because the writings were so few and far between that they could not establish the habit of filing the papers that were written. Approximately complete collections of kindergarten writings were, however, secured from ten Control schools, aggregating only 214 kindergarten children.

These 214 Control kindergarten children wrote a total of about 1000 pieces; the 589 kindergartners in the Experimental schools wrote about 1400 pieces by hand, and about 13,000 pieces with the aid of the typewriters. The number of pieces per pupil written by the Control kindergartners was 4.67; and by the Experimental children by hand 2.37, and with the typewriter 19.3.

The difficulties encountered in analyzing these collections were found to be as great as those the Control teachers experienced in making the collections complete. The attempt to count words was abandoned in favor of a rough classification of all Experimental and Control pieces into six classes, according to the kind and intelligibility of the writing on them. The numbers of pieces per pupil in each of the six classes are shown opposite the definition of each class in Table 5.

While the amount of sense material in these papers is small, the fact of having so

TABLE 5

Numbers of Pieces Per Pupil in Each of the Six Indicated Classifications, Written by Experimental and Control Children in the Kindergarten

Classification	Control	Experimental	
		Handwritten	Typed
Random letters and numerals	.41	.13	9.00
Over half random characters, scattered words, phrases, sentences	.32	.07	5.00
Repetition (for practice) of letters and words, or lists of words	3.11	1.34	3.00
Phrase, phrases, single sentences, or repetition of same with some random letters, words, phrases	.40	.40	1.31
Combination of complete sentences, making sense	.23	.13	.74
Arithmetic, numbers, attempts at combinations and computations	.20	.30	.25
Totals	4.67	2.37	19.30

many attempts at writing from kindergarten children is highly significant; and the tremendous difference between the average number of attempts of the Experimental and Control kindergartners indicates that the classroom typewriter has effected a release of childish impulses " to write." The Control kindergarten children average less than five pieces, while the Typewriter kindergarten children average over 21 pieces per pupil. The Typewriter kindergarten children produce several times as many papers having complete sentences as the Control children produce per pupil. These indications are strongly supported by the teachers' judgments which are analyzed and presented in considerable detail in Chapters VI and VII, below.

CHAPTER V

CHILDREN'S WRITINGS: SECOND YEAR

Introduction

In the preceding chapter we have presented evidence indicating that the Experimental children, during the first year of their use of the typewriters, wrote more and longer pieces of all kinds than the Control; that they exceeded the Control pupils in the number and length of original pieces written; that the total amount of their *handwritten* work was greater in the early grades, and not significantly less in the upper grades, than the total amount of writing done by the Control pupils; and finally that the Experimental pupils wrote more very long original pieces than the Control pupils.

Such questions as the following naturally arise: Was the greater writing activity of the Experimental pupils only a temporary "spurt" due to the novelty of the machines, and to the general stimulus of the experimental situation; or was it the beginning of still greater writing activity during the second year? Did the children's increased experience with the machines lead them to do a larger share of their writing by machine, and a smaller share by handwriting; or did the new medium of written expression stimulate them to greater productivity of handwritten work? The influence of the typewriter on the amount, variety, and content of writings which the children do by hand is far more important educationally than the influence on handwriting quality and rate, but it is apparent that the two influences are not unrelated, and that the answers to these questions will have a bearing on handwriting quality as well as on the intellectual discipline derived from writing activities.

The purpose of the present chapter is to answer these and similar questions, in so far as a rough quantitative analysis of the second-year writings of a small group of Experimental pupils can supply answers to such fundamental questions.

Matched cases. In order to compare the influence of the classroom typewriter on the writing activities of pupils during the second year of its use, with its influence during the first year, it is necessary to compare the first- and second-year writings of pupils who are as nearly equal in all significant respects as possible. The comparisons made in this chapter are therefore based on the first- and second-year writings of the same Experimental pupils. In the four cities mentioned in the preceding chapter the number of Experimental children for whom written collections were available for both years was found to be 580. The grade distribution of these 580 pupils in May 1931 was as follows:

Grades	1	2	3	4	5	6	Total
Numbers	10	95	100	125	120	130	580

The small numbers of cases available illustrate the difficulty of following the *same* pupils through more than one school year. Only ten pupils could be found in the first grade of the Experimental schools in four cities who had been in Experimental kindergarten classes the preceding year in the same cities. However, in view of the fact that all matched cases in each grade have been

included, and in view of the fact that the comparisons are based upon the writings of the *same* pupils, in the first and second years of their use of the machines, it is believed that the results presented below afford valid indications of the second-year as against the first-year influence of the classroom typewriter on the quantity of writing done by pupils.

The second-year materials were analyzed in the same way as the first-year materials, and the results will be presented here in a way closely similar to that employed in the preceding chapter.

Quantity of Writing Done by Experimental Children in the Second Year

Quantity of all writings. Chart 25 indicates that the 580 Experimental pupils described above wrote more in the second than in the first year of their use of the typewriters. Part of the increased writing activ-

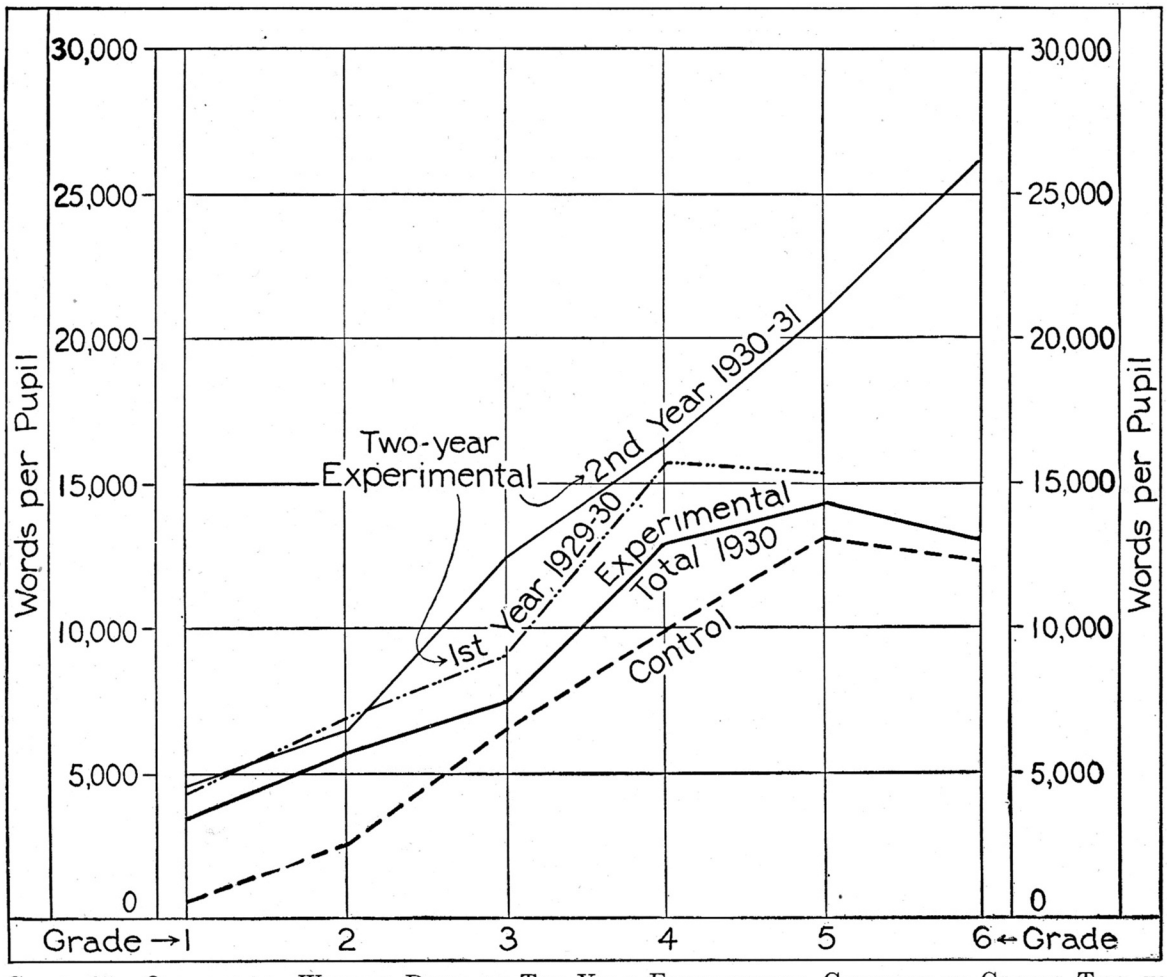


Chart 25. Quantity of Writing Done by Two-Year Experimental Children in Grades Two to Six During the Second Year, Compared with Quantity Written by Same Children During the First Year, When They Were in Grades One to Five

The 1929–30 total Experimental and Control lines are included in this chart for general orientation purposes. The dash-dot line represents 1929–30 data, and the solid line represents 1930–31 data for the same groups of children. The average words per pupil for the various groups are plotted over their respective grade positions at the end of each year.

ity was, of course, due to the normal growth of one year; but after making liberal allowance for this normal increase due to being a year older and in a higher school grade, there is still a considerable excess increment in quantity of writing done, except in grades one and two. In grades one and two the increase in quantity of writing done in the second year over the quantity in the first year seems to be no more than the normal increase due to being a year older and in a higher school grade.

It should be noted that in Chart 25 the average words per pupil for the various groups are plotted over their respective grade positions at the end of each year. Thus the average production in words per pupil of the 1931 sixth-grade group is plotted over grade six; the 1929–30 average production of these same pupils is plotted over grade five, since in 1929–30 they were in grade five. In order, therefore, to compare the quantities of writing done by a given group of pupils in each of the two years, points on two grade ordinates must be compared.

The fundamental comparisons of this chapter are between the first- and second-year writing productivities of the *same* groups of pupils. The 1929–30 total Experimental and Control lines are included in Chart 25 only for general orientation purposes. Comparisons of these lines with the second-year line cannot be made directly, because in spite of the random way in which the pupils were selected, the 580 pupils in the second-year group are somewhat superior with respect to written productivity. This is shown by the fact that the first-year productivity of these 580 pupils is larger in quantity per pupil in all grades than that of the total group of 1276 Experimental pupils in 1929–30.

We have already noted the fact that the teachers did not begin to save the arithmetic papers of the pupils until late in October 1929. The absence from the first year's collections of the arithmetic papers of the first six weeks accounts for a part of the second-year superiority in quantity of writing, particularly in the upper grades; but even if a third of the apparent superiority in the upper grades is attributed to this cause, there remains a large margin of superiority associated with the second year's use of the machines.

It is reasonable to suppose that the teachers were more successful in saving the written work during the second year. As will be seen in Chart 28 below, the numbers of pieces written in the second year are somewhat larger in the upper grades than the numbers written in the first year. But it is known that the teachers were very careful in saving the pupils' writings during the first year, and any greater success they may have had during the second year in approaching a one-hundred-per-cent salvaging record could hardly account for the greater average length of the pieces in grades five and six shown in Charts 29 and 30. Considering all the evidence, it seems safe to conclude that the influence of the classroom typewriter in increasing the writing activities during the first year continued to operate in the second year with at least equal effectiveness. In the upper grades, the data at least suggest that this influence was greater during the second than during the first year.

Quantity handwritten and typed. Chart 26 shows that the classroom typewriter, in the second year of its use, not only did not lessen the amount of handwritten work done by the pupils, but was compatible with a large increase in the handwritten work of the pupils, notably in the upper grades. Only in grade two is the amount of handwriting less in the second year than in the first year.

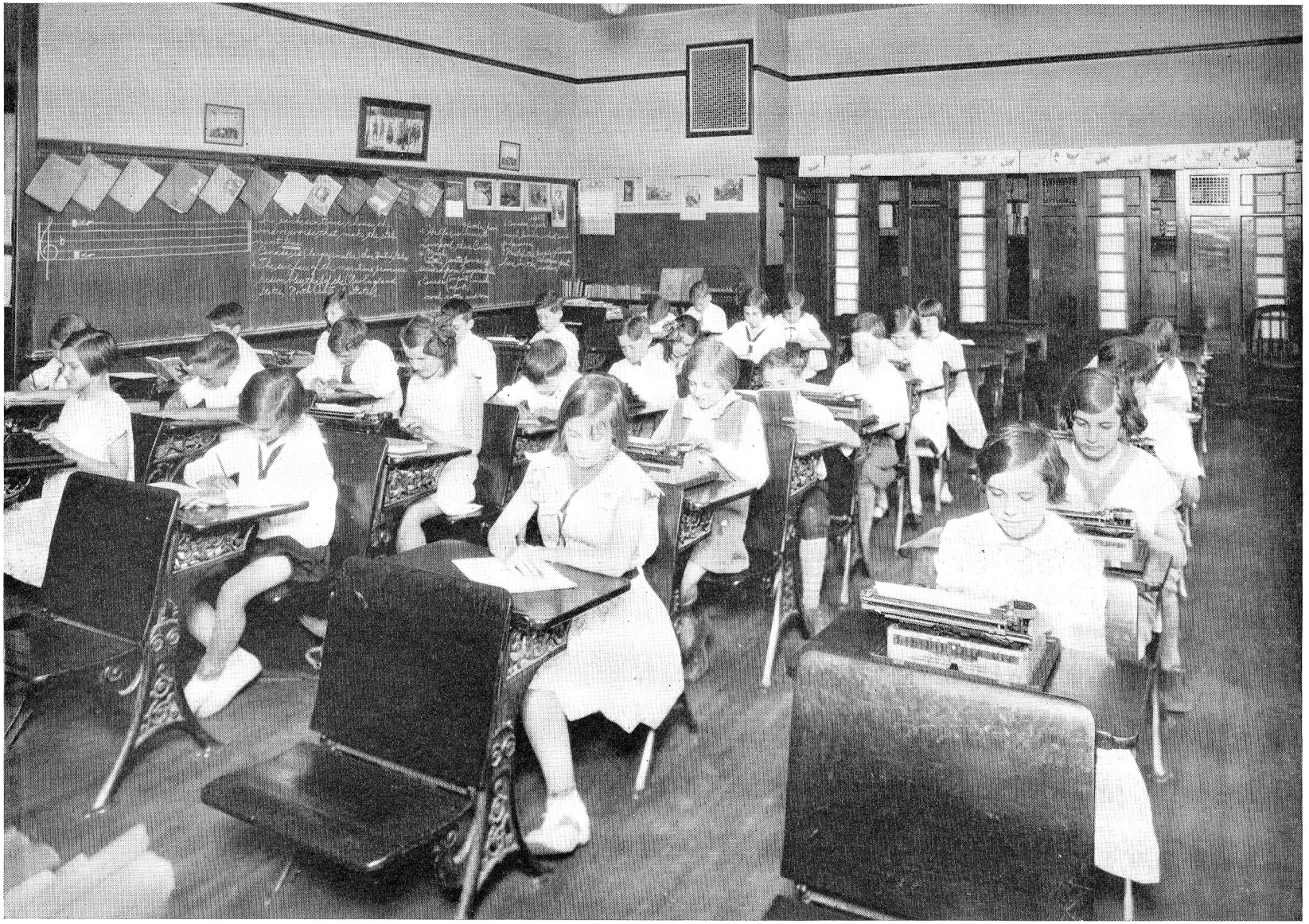


PLATE 5. THE TYPEWRITERS IN A FIFTH-GRADE CLASSROOM

While half of the children are writing at the machines, the others are studying or practicing handwriting.

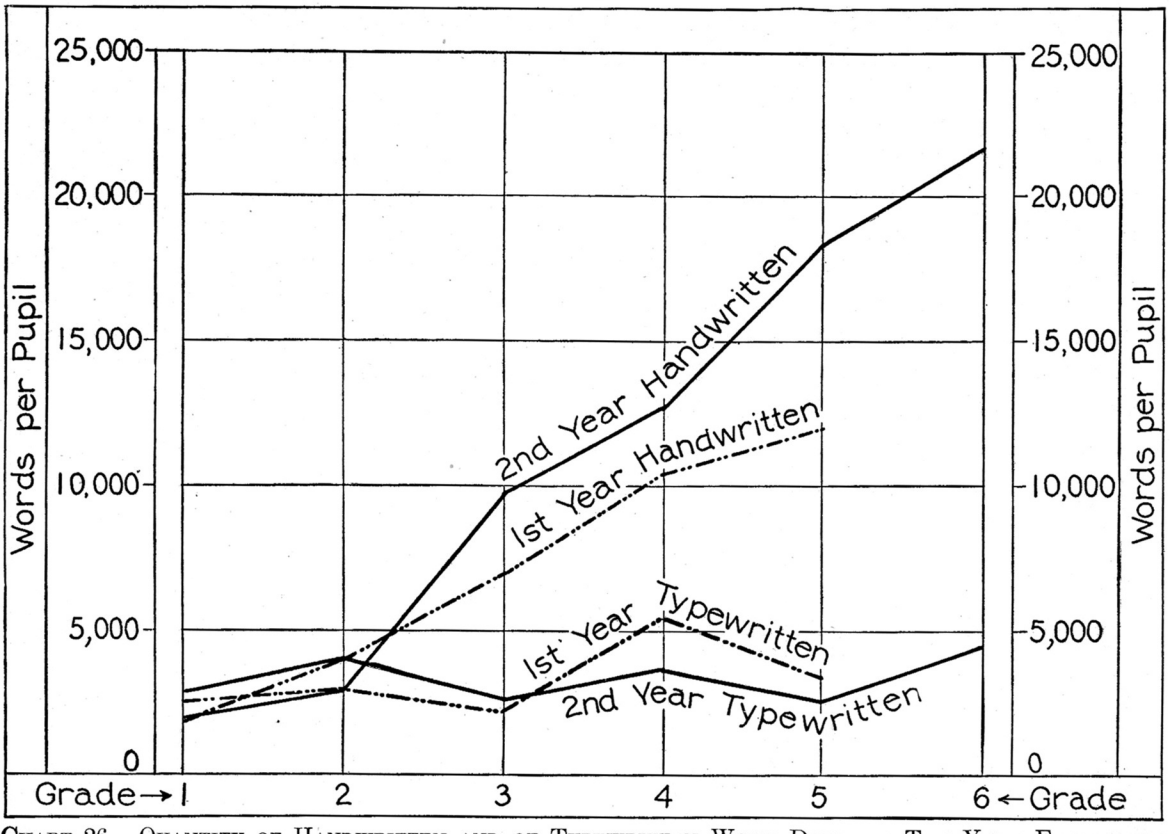


CHART 26. QUANTITY OF HANDWRITTEN AND OF TYPEWRITTEN WORK DONE BY TWO-YEAR EXPERIMENTAL CHILDREN IN THE SECOND YEAR, COMPARED WITH THEIR CORRESPONDING PRODUCTIVITIES DURING THE FIRST YEAR

The dash-dot lines represent 1929–30 data, and the solid l nes represent 1930–31 data for the same children.

In the first two grades the differences are too small to be considered significant, but in the upper grades, the typewriters, far from "displacing" handwriting in our schools, seem to have increased the effective use of handwriting in the elementary school. Assuming the large pedagogical values widely attributed to writing as a school activity, and assuming that the increased writing of these children is causally connected with the use of the machines, Charts 25 and 26 indicate that the classroom typewriter has made a large contribution of fundamental educational worth. If, as the teachers suggest in Chapters VI and VII, the typewriter has helped to improve the attitude of the pupils toward writing and school in general, the increased amount of writing indicated in these charts is just what we should expect.

The amount of typewritten work in the second year is greater than in the first year in the lower grades, but is somewhat less in the upper grades. Of course, no great increase in the amount of typing could take place, because the amount of typewriting possible was strictly limited by the ratio of the number of machines to pupils (on the average one to four), and by the number of school periods which could be devoted to using the machines. Thus any greater zeal for writing in the upper grades would have to manifest itself in greater handwriting activity. Perhaps if more machines had

been available, some of the writing that was done by hand would have been typewritten; or perhaps more would have been typed without lessening the increase in handwritten efforts. In any case, it is apparent that a ratio of one machine for four pupils is sufficient to effect a substantial increase in the writing activities of pupils, and that this increase is greater in the second year than in the first in the upper grades.

The contribution of the classroom typewriter to the writing productivity of younger pupils is outstanding throughout this report. In Chart 26 it appears that the upper-grade pupils write from three to five times as much by hand as by machine in the second year; but in grades one and two the pupils write from one-third to one-half as much again on the typewriters as by hand.

Quantity of original writing. The lines in the lower part of Chart 27 indicate that the typewriter played as large a part in the original composition work of the pupils in the second year as in the first year, in all

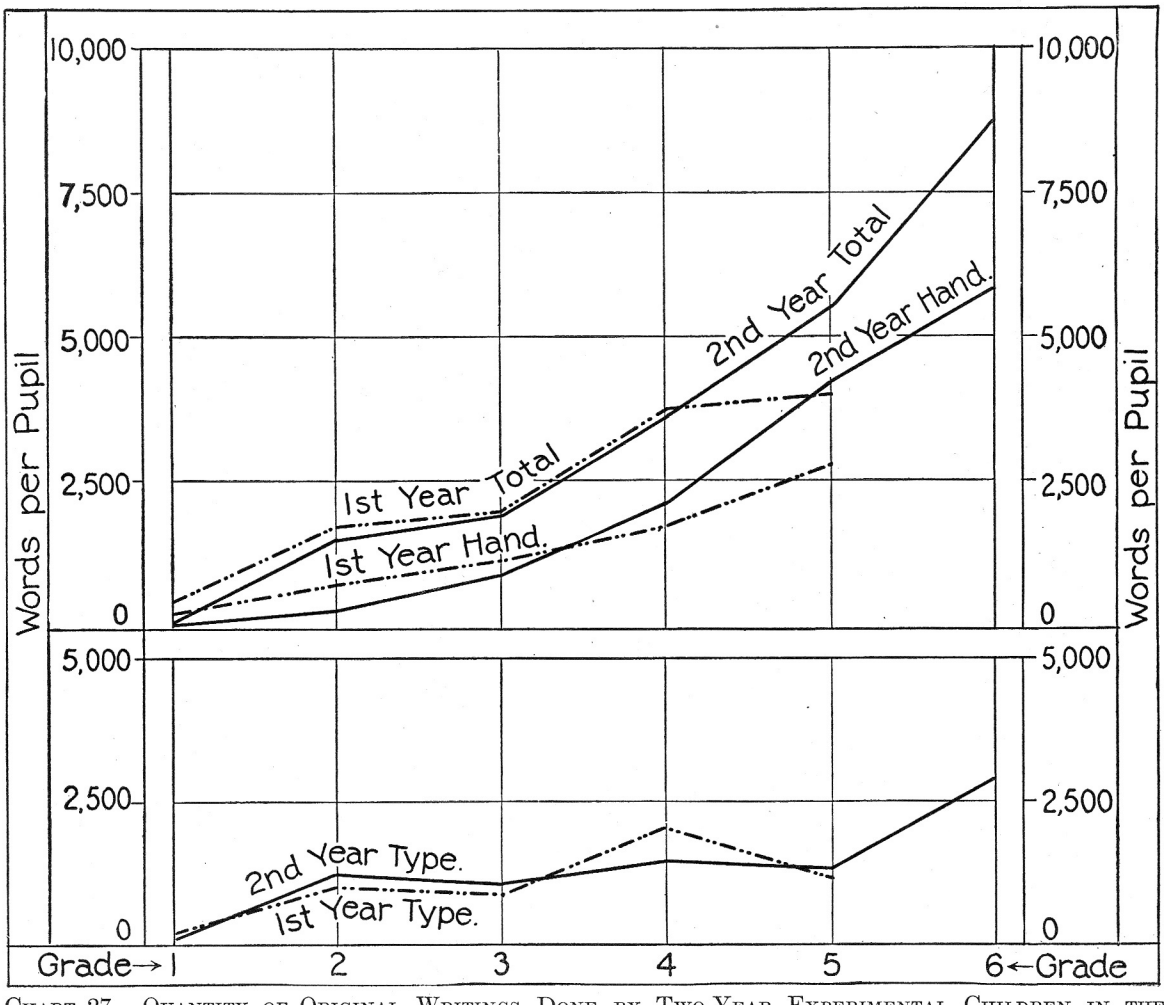


CHART 27. QUANTITY OF ORIGINAL WRITINGS DONE BY TWO-YEAR EXPERIMENTAL CHILDREN IN THE FIRST AND SECOND YEARS IN TERMS OF TOTAL WORDS WRITTEN PER PUPIL

In addition to the lines representing total original writings for each year, there are lines representing separately handwritten original work and typewritten original work for each year.

grades except the fourth. The lines in the upper part of Chart 27 show that the quantity of original writing, both handwritten and typed, was somewhat less in the second than in the first year in grades one to four. This is due in part to a measurable decrease in the amount of handwritten original composition done in grades one to three, and is in contrast with the slight increase in typed original composition work in grades two and three.

In grades four to six the amount of handwritten original work is greater than in the first year; and in grades five and six the total amount of original writing, hand and typed, is greater than in the first year.

The fact that about one-half of the original writing in the lower grades, and between one-fourth and one-third in the upper grades, is done on the typewriter, indicates that there is a very fruitful relation between the classroom typewriter and original writing by pupils in the elementary school.

Quantity of copied writing. As indicated

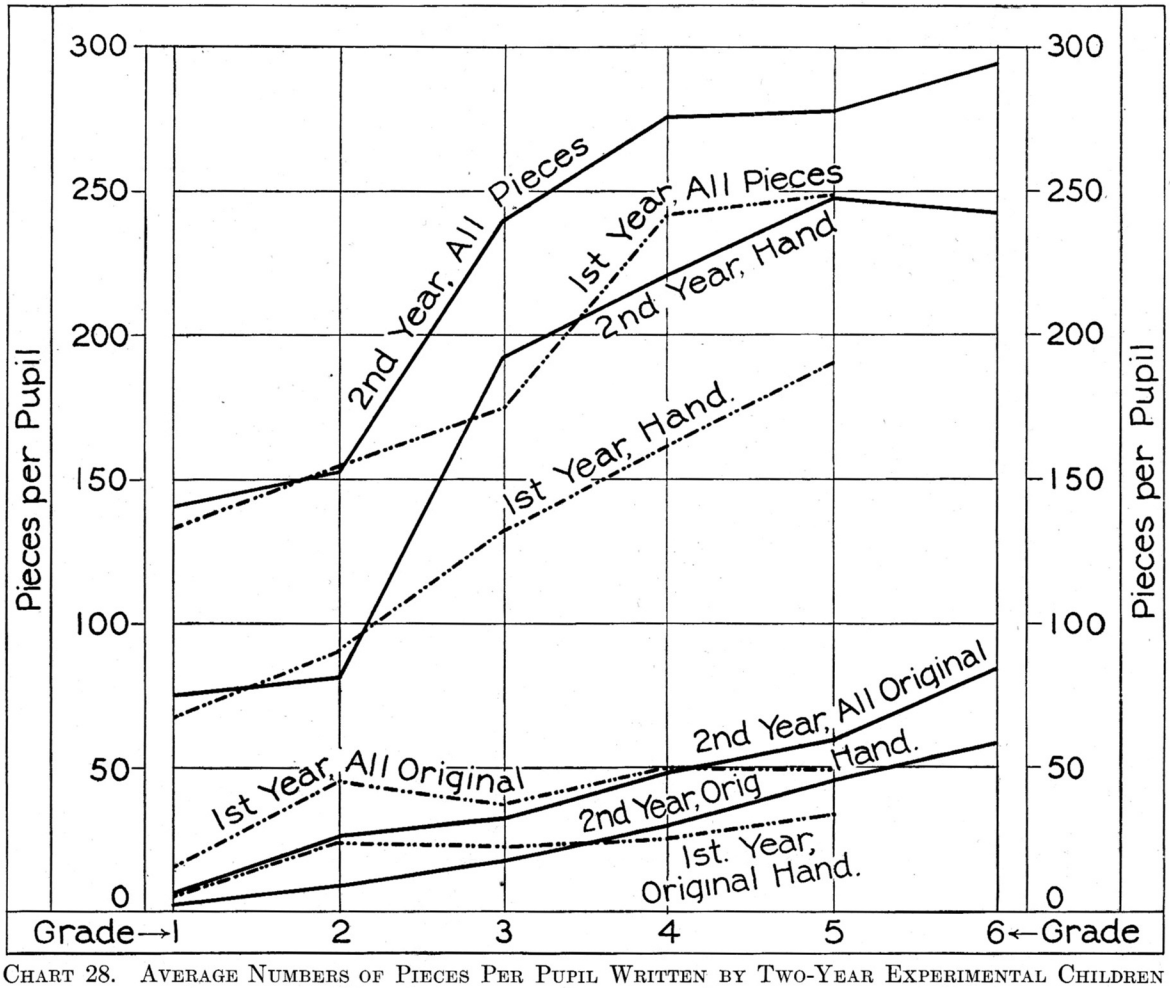


CHART 28. AVERAGE NUMBERS OF PIECES PER PUPIL WRITTEN BY TWO-YEAR EXPERIMENTAL CHILDREN IN EACH GRADE IN THE FIRST AND SECOND YEARS

The lines at the top refer to total pieces of all kinds, handwritten and typed; the next pair of lines refer to all pieces handwritten; and the lines at the bottom of the chart represent the averages of all original pieces, and of handwritten original pieces for these same groups.

in the preceding chapter copied work includes all practice writing for the purpose of improving handwriting quality or typing skill, all copied sentences, paragraphs and lists of words or sentences or phrases, and all arithmetic papers. Most of the increase in total quantity of writing of the second year over the first year is due to the large increases in quantities of handwriting practice and arithmetic writing, the quantity of other copied work, sentences, lists, etc., being about the same in the second as in the first year. The part that the typewriter played in these three kinds of writings was about the same in both years, and about the same as for the total Experimental groups as shown in Charts 19, 20, and 21 in the preceding chapter.

Number and Length of Pieces Written in Second Year

Numbers of pieces written in second year. Chart 28 shows that the total numbers of pieces per pupil written in the second year were greater than in the first year in all grades except the second. The increase in grade one was very slight. Except in grades one and two there was a considerable increase in the number of pieces handwritten. The relations between the handwritten and the total increases shown by the lines of Chart 28 show that there was a slight decrease in the number of typed pieces in grades four to six and a slight increase in grades one to three; but the large increases in numbers of handwritten pieces are more than enough to offset the loss in numbers of typed pieces.

The lines at the bottom of Chart 28 show that the total number of original pieces written decreased in the lower grades and remained about the same in the upper grades. The decrease in the lower grades is in the number of original handwritten pieces. The number of typed original pieces remained about the same in both

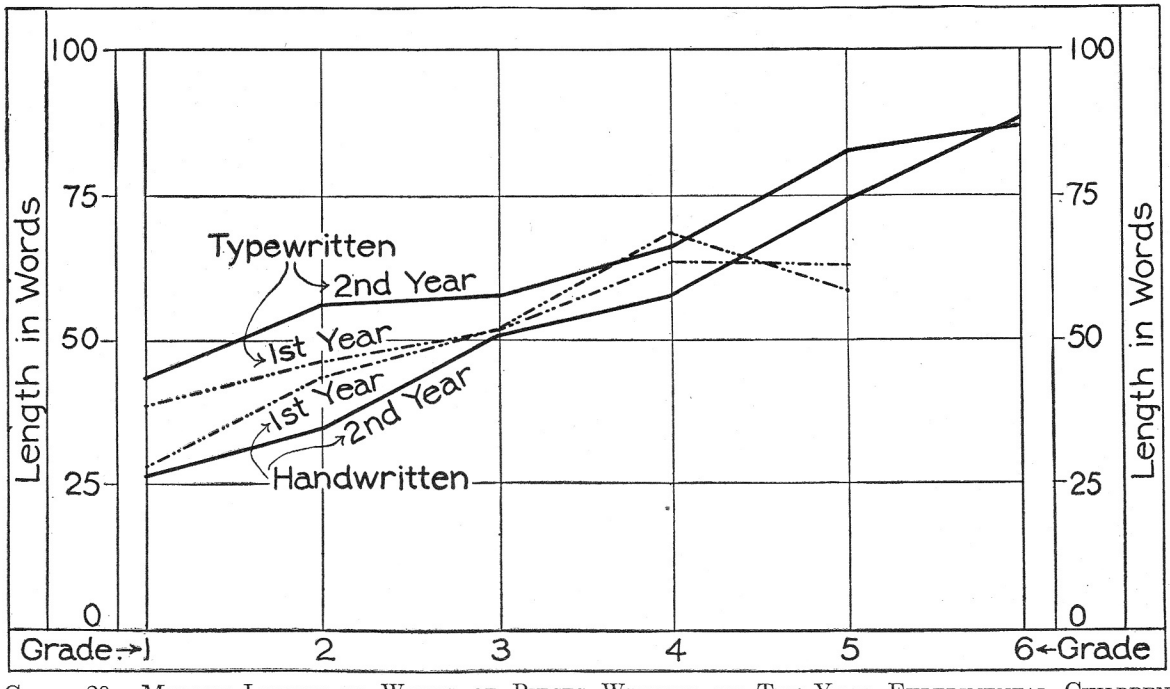


Chart 29. Median Length in Words of Pieces Written by Two-Year Experimental Children in Each Grade in the First and Second Years

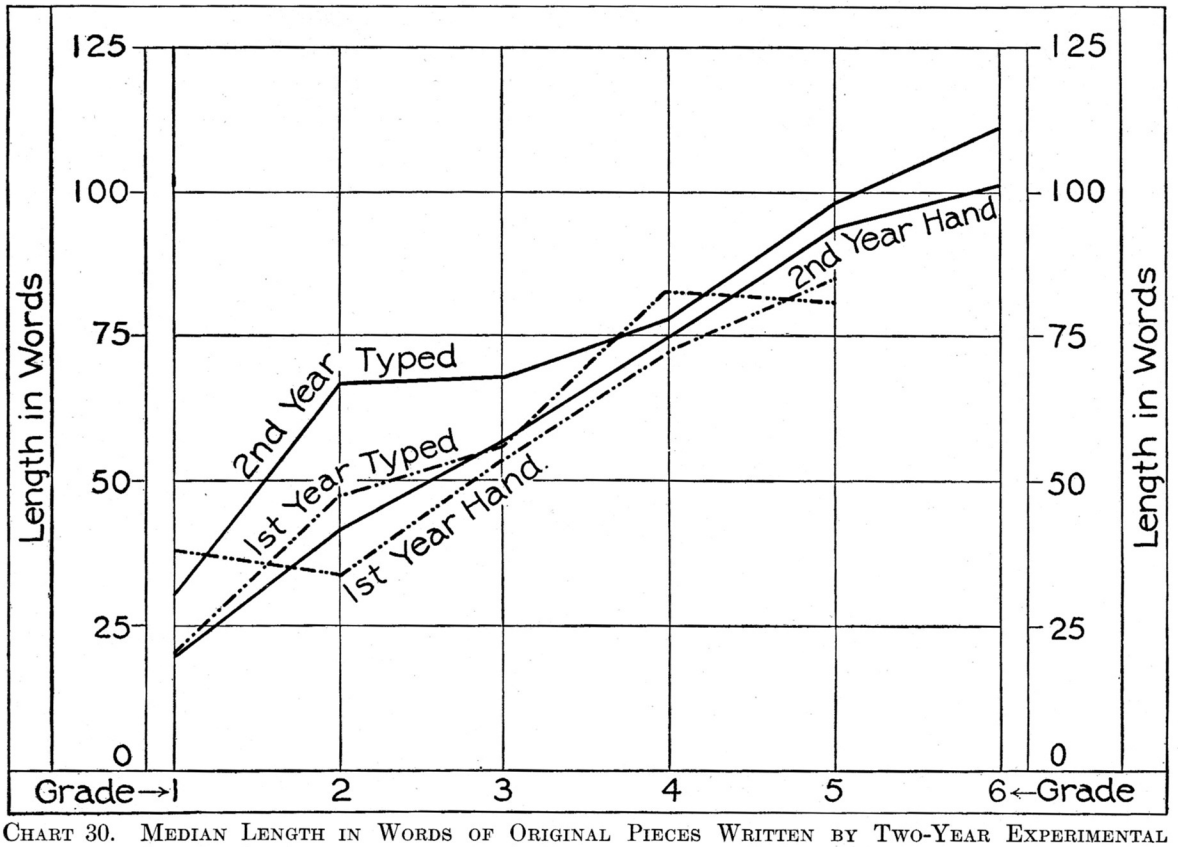


CHART 30. MEDIAN LENGTH IN WORDS OF ORIGINAL PIECES WRITTEN BY TWO-YEAR EXPERIMENTAL CHILDREN IN EACH GRADE IN THE FIRST AND SECOND YEARS

years in all grades, as may be seen from the relations of the handwritten total lines at the bottom of Chart 28.

Median length of pieces in the second year. Chart 29 shows that the length of typed pieces in the second year was greater in all grades except the fourth, and that the handwritten pieces are somewhat shorter in the second year than in the first year in all grades except the fifth and sixth, in which they are much longer. These relations are important because they indicate something of the attitude of pupils toward typewriting and toward handwriting. In Chart 28 it was shown that the number of typed pieces was about the same in both years; but Chart 29 shows that the typed pieces were considerably longer. In contrast with this, Chart 28 showed that the number of handwritten pieces increased, but Chart 29 shows that the handwritten pieces are somewhat shorter in the second year than in the first year. These indications will be recalled in Chapter VII in connection with the teachers' judgments to the effect that pupils do not seem to become fatigued as quickly when typing as when handwriting, and in connection with the suggestion made by some teachers that in writing longer pieces the typewriters afforded a welcome relief from sole dependence on the pen.

Median length of original pieces written in the second year. The suggestion made in connection with Chart 27 that the classroom typewriter has an especially fruitful relation with the more creative writing tendencies of pupils is supported by the indica-

tions of Chart 30. This chart shows that the typed original pieces are longer in the second year than in the first in all grades except the fourth. In grades one and two the second-year typed pieces are roughly 50 per cent longer than the first-year typed pieces, and they are more than 50 per cent longer than the second-year handwritten pieces in these same grades. Chart 30 shows that in all grades the second-year typed original pieces are longer than the second-year handwritten original pieces. These relations suggest again the potentialities of the classroom typewriter for giving more effective and satisfying expression to the creative writing tendencies of pupils in the elementary school.

Typewritten Work in Sight-Conservation and Special Classes

In two or three of the Experimental schools there were sight-conservation and other special and auxiliary classes for children with poor vision and children handicapped in other ways. Through the coöperation of the Typewriter Educational Research Bureau, large bulletin type machines were provided for the sight-saving classes, and primer type machines were placed in the special auxiliary classes. The writings of the children in these classes were collected for both years in the same way as the writings of children in the normal classes.

A careful analysis of the writings has not yet been made, but such study as we have been able to make confirms the judgment of the teachers to the effect that the machines were of great value to the handicapped children. The inestimable value of the large bulletin type machines, and the advantages of touch typing, for children in sight-saving classes have long been recognized by teachers experienced in sight-conservation work. The following quotation is typical of the attitude of sight-conservation teachers toward bulletin type machines:

"Bulletin typewriters are also a boon to the teachers of these classes, for there are still some lessons to be prepared for the children. Work copied with a heavy drawing pencil or with india ink is soon in disrepair. With the use of the bulletin typewriters work is much more legible, is more quickly prepared by the teacher, and more easily preserved and filed for future reference." [1]

The value of primer type machines for children of mildly defective vision has been recognized by many of the teachers in this experiment.

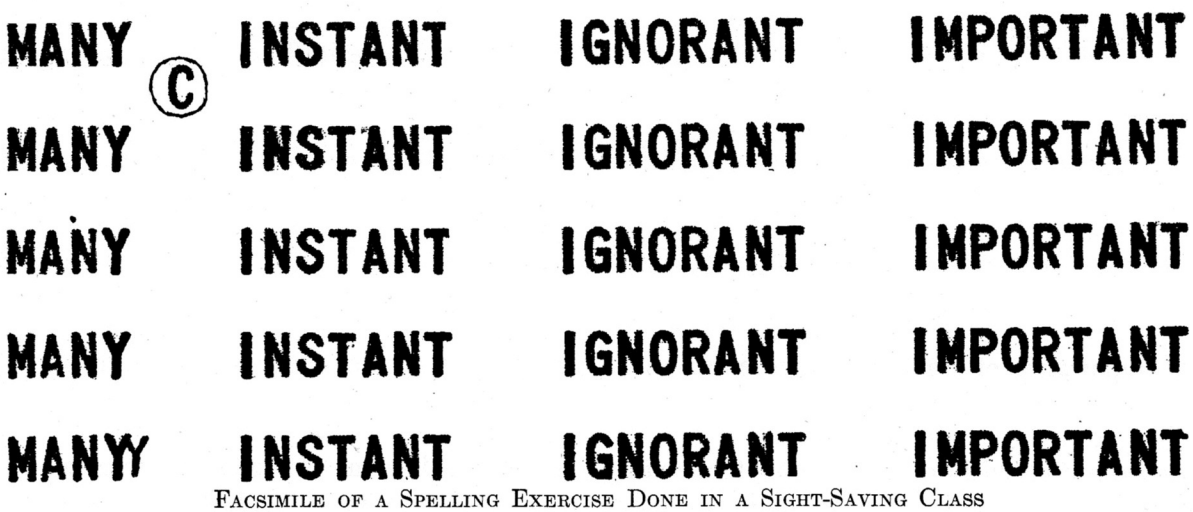
The nature of the contribution of the typewriter to the children in the sight-conservation and special classes is indicated in the following memorandum which was kindly supplied by the elementary school supervisor in one of the coöperating centers:

Sight-Conservation Class. The finest contribution made by the machine class was in the large amount of original material created and typed by individual children. This was made available to all in the group and added considerably to the limited amount of reading material. The magazine produced by these boys and girls is a fine example of this use of the machine.

Compared with the material available for reading in the classroom of normal children, that in a sight-conservation class is extremely limited. Only a few of our textbooks are printed in this type and they are expensive. The machine may be used by the teacher for copying available small type material and for developing original material.

The teacher in charge has doubtless written about her plans for the development of the school library, and the contribution of the machines to this project. It was interesting to see these children establish contacts with all classes of the school. Bulletins of interest to all were typed and posted daily. Book reviews were typed and

[1] Dunlop, Gladys L., "Sight Saving in the Schools," *Journal of the National Education Association*, November 1929, page 269. See also *Progressive Education*, April 1931, page 328.



FACSIMILE OF A SPELLING EXERCISE DONE IN A SIGHT-SAVING CLASS

This paper was prepared by a 6B pupil who had used the typewriter for two months. He obtained five practices on each word. The machine was equipped only with large capitals.

distributed to the boys and girls who might be interested. The children who did the typing were able to read the reviews and the large type commanded the attention of children whose vision was normal, just as headlines in the newspaper command our attention.

Unless the teacher is extremely resourceful children with sight handicaps develop habits of idleness in addition to poor work habits. The machines multiply interests and help these children to produce a printed page which is well planned and arranged in such a way as to invite the reader.

Girls' General Auxiliary Class. This class enrolls girls of low-grade mentality and is typical of many classes in which the typewriter has long been considered a piece of valuable equipment.

The education of these girls is along many practical lines. Housekeeping, buying and keeping accounts, planning meals, typing recipes, and directions for sewing are all a part of the daily work. The machine has become a practical instrument in all of these activities. A typed recipe is a little more worthy of being preserved for future use than one in handwriting. Schedules of housekeeping duties typed and posted carry a little more conviction than those which are written.

Bookkeeping is necessary where spending money is involved. Household accounts are kept in typed form. This includes the purchase of all foods, sewing materials, and materials for shop work. This class of girls had charge of the sale of milk for morning nourishment to all children of the Elementary School of which they are a part. Orders were typed, milk sold, and accounts typed and checked. This became an everyday business transaction in which the typewriter undoubtedly contributed to the learning of the children.

There is a wide range in the reading ability of these children. Through such experiences as are noted above children acquire a practical reading vocabulary. In addition to this the teacher, through the use of the machine, finds it possible to develop much material with the needs and ability of individual pupils in mind.

CHAPTER VI

TEACHERS' JUDGMENTS ON THE GENERAL INFLUENCES OF THE CLASSROOM TYPEWRITER

Introduction

Importance of teachers' judgments. Attention has already been called to the fact that the test results and other types of evidence presented in preceding chapters could not possibly reflect all of the influences of a classroom instrumentality which touches such fundamental aspects of education as writing and reading, the schedule of classroom activities, and the organization of the classroom as a social unit. It is obvious that there are some influences which could be sensed and reported only by the teachers and pupils themselves. Among these are some aspects of the influences of the typewriter on the attitudes and interests of pupils, on their social conduct and civic habits, the influences of the machines on the pedagogy and organization of the classroom, and on various classroom management problems. Not only do the judgments of the teachers and pupils constitute our only source of information on some of these influences, but they throw some light upon the influences of the typewriter on the achievement of pupils in the individual subject matters. It was therefore a part of our original plan to secure in writing the considered judgments of the teachers on the general and specific educational influences of the typewriter as a classroom instrumentality.

Questionnaires. For this purpose the teachers were asked to answer a series of three questionnaires: (*a*) the first one was answered in December 1929, two months after the experiment began, by 152 of the 164 teachers to whom questionnaires were sent; (*b*) the second one was answered by 159 teachers at the end of the first year, May 1930; (*c*) the third one was answered by 166 teachers at the end of the second year in May 1931. Some of the teachers who answered these questionnaires were in charge of Typewriter classes for only one year, and a few for only one semester. On the assumption that the judgments of teachers who have been in charge of Typewriter classes for two full school years would be more valid and reliable, we shall confine ourselves in this chapter to the answers of the 116 teachers who answered all three questionnaires. These 116 teachers represent all of the Experimental centers and schools that participated in the experiment except the three private schools in which our full schedule of achievement tests was not given. (Schools J, L, M; see Chapter I.) The grade distribution of these 116 teachers was as follows: kindergarten, 14; grade one, 25; grade two, 18; grade three, 19; grade four, 13; grade five, 11; grade six, 13; and special classes, 3.

Validity of teachers' answers to the questionnaires. In weighing the evidence presented in this and succeeding chapters the reader must keep in mind the scientific limitations of questionnaire data in general, and of subjective judgments in particular. In the following pages we present as adequate a picture of the attitudes and judgments of the teachers as possible within our space limitations; but the reader should be

on guard against the " halo effect " which tends to confuse attitudes with judgments, enthusiasms with concrete observations. There is evidence throughout the following chapters that the judgments expressed on some questions should be interpreted as expressions of general enthusiasm, rather than as testimony based on specific observable facts. This reservation is in no sense derogatory to the teachers who have so generously coöperated in this enterprise; on the contrary, it is a condition for interpreting subjective reports upon which our Experimental teachers themselves would insist. Nor does this reservation mean that the attitudes and enthusiasm of the teachers should be ignored as irrelevant. On the contrary, evidence on the attitudes and feelings evoked by the classroom typewriter is as important in one way as evidence of their considered judgments and observations is in other ways.

Our confidence in the significance of the teachers' attitudes and judgments as recorded on the questionnaires is upheld by several considerations. In the first place, the judgments expressed in the second and third questionnaires are based on one and two years of daily experience with the typewriter in the classroom under rigorous experimental conditions. In the second place, while the work of adapting the machines to classroom purposes was reported as easy and pleasant, the burdensome extra tasks imposed by the requirements of the experiment through one year, and more especially through two full years, make it improbable that any favorable answers would be given because of momentary or false enthusiasm due to the novelty of the machines. These extra burdens included the careful administration of many tests, the saving of all the writings of the pupils, and the making of many written reports, in addition to answering the questionnaires with which we are here concerned. In the third place, concrete evidence is demanded by many of the questions in the questionnaires for the opinions and judgments given, and in many cases such evidence is given by the teachers, often in considerable profusion. The great majority of the questionnaires bear internal evidence that they were answered carefully and thoughtfully. In the fourth place, adverse opinions are freely given, although nearly always very briefly. Finally, the pooled judgments of the teachers are in general agreement with the evidence presented in preceding chapters and with our own observations.

The Typewriter and the General Aims of Education

As indicated in Chapter I, our primary interest in this investigation has been not in typing as an end in itself, but in the influences of the classroom typewriter on education in the broadest sense of the term. While we have studied typing as a means of expression in relation to various kinds of elementary school achievement, we have been anxious to learn as much as possible about the general compatibility of the classroom typewriter with the accepted aims and goals of elementary education. We have therefore included in one or more of the questionnaires some questions on the general influences of the classroom typewriter. The answers to these will be presented first.

The typewriter and the aims of elementary education. Table 6 shows the result of our effort to secure the judgment of the Experimental teachers on the compatibility of the classroom typewriter with twenty of the widely accepted general aims of elementary education. The table includes an exact reproduction of the questionnaire except that the order in which the aims were listed on the questionnaire was different.

TABLE 6

PERCENTAGES OF TEACHERS WHO, AT THE END OF THE FIRST YEAR (MAY 1930), JUDGED THAT THE TYPEWRITERS WERE AN AID IN ATTAINING TWENTY OF THE ACCEPTED AIMS OF ELEMENTARY EDUCATION

Except for the columns of per cents at the right, and the order in which the aims are listed, the questionnaire is here reproduced exactly in the form in which it was sent to the teachers. The order here is according to per cent of positive answers; the original order in which the aims were listed is shown by the numbers in parentheses at the left. The per cents are based on returns of 116 teachers who were in Typewriter classes two years; the per cents based on returns from the 155 teachers in the first year who answered are almost identical with these, being within two points for each aim.

AIMS OF ELEMENTARY EDUCATION

The following are some of the generally accepted aims of elementary education. If, in your judgment, the use of the typewriter in the classroom aids in attaining an aim, draw a ring around "Yes" after the statement; if in your judgment the use of the typewriter has no influence in attaining the aim, draw a ring around "No"; if the effect is uncertain, put a ring around the question mark after the aim.

		PER CENTS GIVING EACH ANSWER		
		Yes	No	?
1.	(1) To supply the child with stimulating materials and the opportunity to work out successfully the ideas suggested	94	1	5
2.	(5) To give training in coöperation and mutual helpfulness	93	3	3
3.	(8) To develop a sense of personal responsibility	92	2	6
4.	(3) To provide activities which continually widen the interests and understanding of the child	91	3	6
5.	(6) To provide opportunities for practice in fair play	88	4	7
6.	(4) To provide activities suited to the child's individual needs and abilities	81	5	14
7.	(7) To develop self-reliance in making and executing plans	75	5	15
8.	(2) To provide opportunity for the exercise of the best of the child's natural tendencies	74	9	15
9.	(13) To give practice in the use of tools, implements, and materials needed for entrance into the larger social life	72	8	17
10.	(10) To provide companionship so that each child may profit from the stimulation of his fellows	71	12	15
11.	(11) To provide opportunity to learn the physical properties of things	60	14	21
12.	(19) To give training in clear and correct speaking and writing	57	21	17
13.	(16) To develop skill and ease in reading	42	20	36
14.	(18) To provide practice in the number operations	35	37	22
15.	(14) To develop an appreciation of beautiful things, both in nature and in the works of man	27	39	30
16.	(17) To develop discriminative taste in the choice of reading material	24	46	25
17.	(20) To develop a sense of the relation of our generation to the history of man	22	46	26
18.	(15) To give opportunity for the development of an adequate set of health habits	15	54	25
19.	(9) To develop a willingness to suspend judgment until the evidence is all in	9	38	50
20.	(12) To provide acquaintance with the common animals and plants	7	62	28

The order in which the aims appeared on the questionnaires is indicated by the numbers in parentheses at the left of each aim. The aims were purposely placed in random order on the questionnaire so that the aims most obviously or plausibly influenced by the typewriter would not be grouped together.

It is interesting to note that in the opinion of from 80 to 94 per cent of the Experimental teachers at the end of the first year of the experiment, the classroom typewriter is positively helpful in attaining the most general aims of elementary education, particularly those aims concerned with the individual as a worthy member of society, including such character traits as coöpera-

tion, mutual helpfulness, personal responsibility, the practice of fair play, and meeting the child's individual needs and abilities. Seventy-five per cent of the teachers believe that the typewriter aids in developing self-reliance on the part of the pupils in making and executing plans.

The fact that only 42 per cent of the teachers judge the typewriter positively helpful in developing skill and ease in reading is surprising in view of the fact that in answering another question on reading in May 1930, 65 per cent of these same teachers judged that the classroom typewriter had helped in reading, and one year later, in May 1931, 75 per cent of these teachers gave this judgment. The low figure of 42 per cent can probably be explained in terms of the ambiguity, or rather the inclusiveness, of the phrase " to develop skill and ease in reading," and in terms of conscientious conservatism of the teachers. Conversations and correspondence with teachers revealed the fact that some of the 36 per cent of the teachers who answered " effect uncertain " had observed the favorable effects of the typewriter on vocabulary, spelling, sentence structure, etc., but they could not identify these observed benefits with the generalized aim of effective reading. The addition of these teachers who are known to have been thus careful would raise the figure 42 per cent to 60 per cent, thus bringing it into approximate agreement with the per cent of favorable answers to the other question.

The joining of " speaking and writing " in aim 12 accounts for the fact that only 57 per cent of the teachers give judgments of positively favorable influences. We know from other sources that if the question had been on writing alone the per cent of favorable answers would have been much higher.

Thirty-five per cent of the teachers judge that the classroom typewriter helps " to provide practice in the number operations," 37 per cent say it does not, and 22 per cent are doubtful. While the great majority of teachers knew at the time this question was answered (May 1930) that the children had used the machines in writing some of their arithmetic work, only 35 per cent of them were convinced that the machines helped the children materially in their " number operations."

The aims on which the typewriter would obviously have only a remote influence receive favorable votes from less than one-fourth of the teachers.

It seems clear from Table 6 that, in the judgment of experienced teachers, the classroom typewriter is compatible with the fundamental general aims of elementary education.

Educational values of pupils' activities at the typewriter. While nearly all of the Experimental teachers observed a great variety of pupils' activities at the typewriter, and commented favorably upon the greater interest and self-activity displayed by the pupils at the machines, some teachers felt uncertain about the educational values of some of the activities, particularly in the early stages of the experiment. The superficially random activities, having the external appearance of idle and purposeless " fooling " with the machines, and the " non-sense " products of such activities during the first few months of the experiment in the kindergarten and first grade, and some of the typewriter " stunts " of the older children, made a few of the Experimental teachers skeptical of the value of some of the time spent at the machines. In spite of the frivolous and irresponsible appearance of some of these activities and products, many of the more experienced teachers, impressed by the self-initiated character of the activities and by the intense

interest and persistence with which they were carried out, discerned in them educational values of a high order. As the experiment progressed through the first and second years, the number of teachers who were skeptical of these activities became smaller.

In order to secure an objective record of the teachers' judgments on this point the following question was included in the questionnaire answered by the teachers in May 1931:

The activities which children in my grade carry on with the help of the typewriter are (*a*) of full educational value, (*b*) of some educational value, (*c*) of little or no educational value.

The answers to this question of the 116 two-year Experimental teachers are shown graphically in Chart 31.

The chart shows that 68 per cent of the teachers judge the typewriter activities of the children to be of full educational value. Thirty-one per cent judge that the activities have some educational value, and only one of the 116 teachers expressed a judgment that the activities of the children at the classroom typewriter have little or no educational value. It seems clear that the 116 teachers who had two years of experience with the classroom typewriter indorse the suggestion made by several teachers that "there is nothing that children freely do at the machines that does not have some educational value."

The typewriter and bright, normal, and dull pupils. The test results reported in Chapter II indicate that the excess gains of the Experimental children were about equal for the bright, normal, and dull groups. In order to learn the teachers' judgments on the appeal and value of the classroom typewriter for bright, normal, and dull pupils, the following questions were included in the questionnaires answered by the teachers in May 1931:

The classroom use of the typewriter appeals largely to (*a*) bright children, (*b*) normal children, (*c*) dull children, (*d*) about equally to all children.

The classroom typewriter is of greatest educational value to (*a*) bright children, (*b*) normal children, (*c*) dull children.

Chart 32 shows that the great majority of teachers believe that the typewriter appeals equally to bright, normal, and dull children, but more than half of the teachers apparently believe that the classroom type-

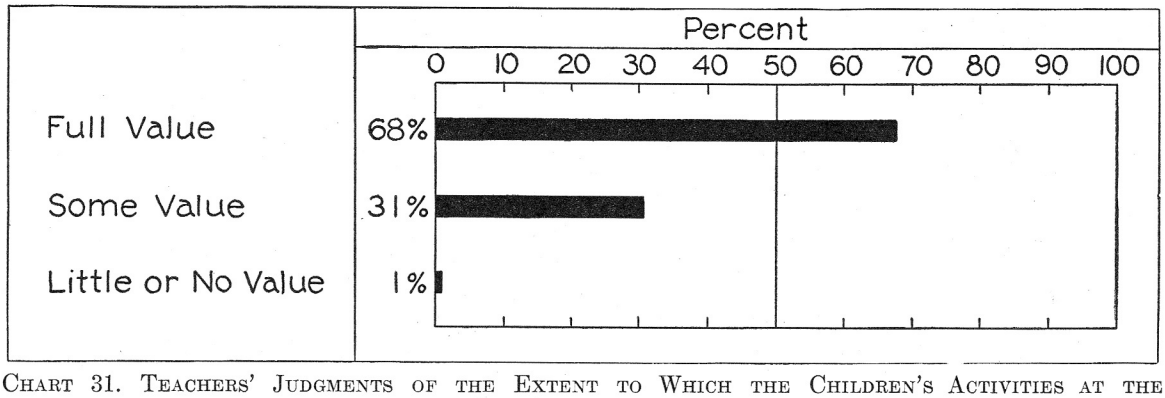


CHART 31. TEACHERS' JUDGMENTS OF THE EXTENT TO WHICH THE CHILDREN'S ACTIVITIES AT THE TYPEWRITERS WERE EDUCATIONALLY VALUABLE

The bars show the proportions of 116 teachers who were in the experiment two full years that chose indicated answers in the following question in May 1931:

The activities which the children in my grade carry on with the help of the typewriter are of:
a. full educational value *b.* some educational value *c.* little or no educational value

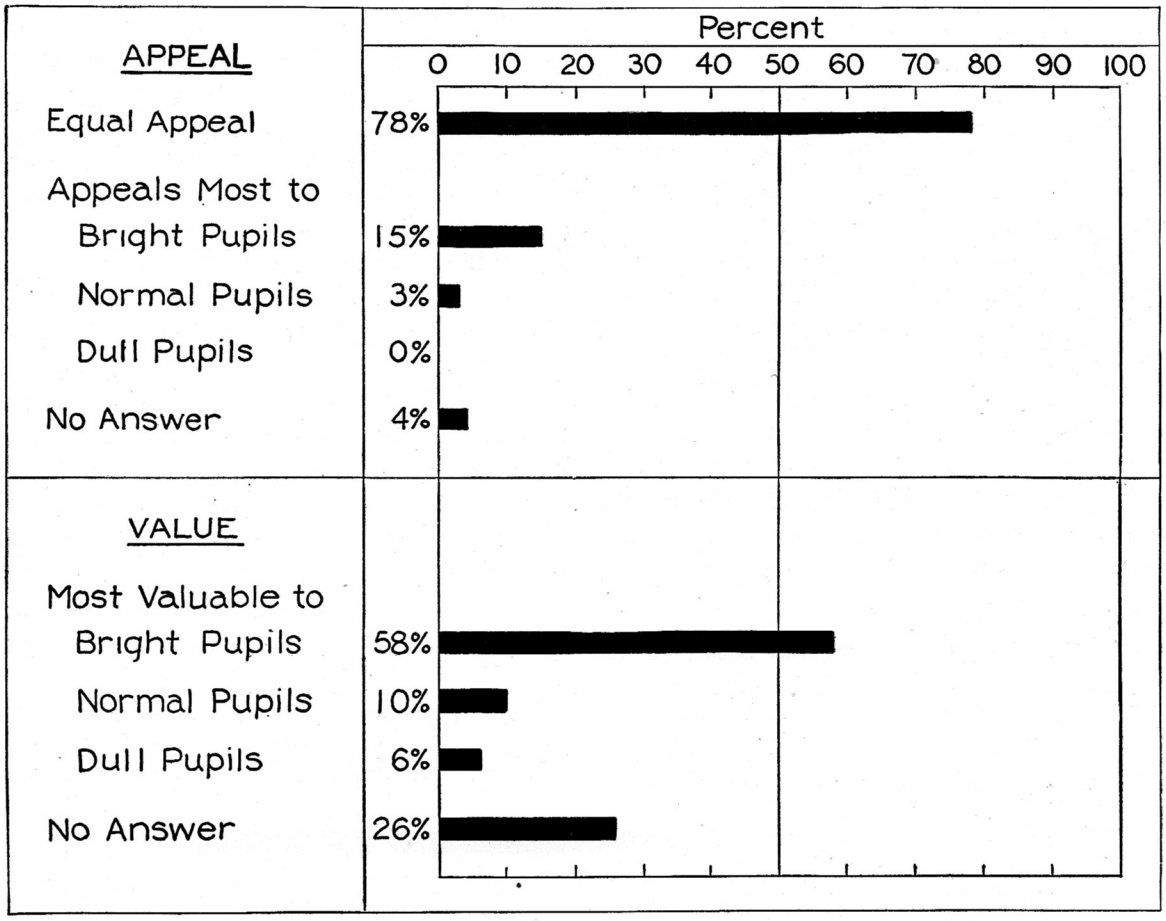


CHART 32. TEACHERS' JUDGMENTS OF THE APPEAL AND VALUE OF THE CLASSROOM TYPEWRITER TO BRIGHT, NORMAL, AND DULL PUPILS

The bars show the proportions of 116 teachers who were in the experiment two full years that chose indicated answers in the following questions in May 1931:

The classroom use of the typewriter appeals:
- *a.* largely to bright children
- *b.* largely to normal children
- *c.* largely to dull children
- *d.* equally to all children

The classroom typewriter is of greatest value to:
- *a.* bright children
- *b.* normal children
- *c.* dull children

writer has greater value for the bright children than for the dull children. Here the judgment of the teachers is at variance with the test results reported in Chapter II, but it is easy to understand that the teachers would be more apt to notice the contributions of the typewriter to the bright children, and that they would tend to compare the bright with the dull children in their classes, rather than compare their dull children with dull children in Control classes. In many cases the effect of the typewriter in releasing the powers of imagination and expression of bright children was so marked as to overshadow the less spectacular but none the less important and genuine contributions of the typewriter to the less gifted pupils.

The Typewriter and the Pupil's School Interests

The questionnaires answered by the Experimental teachers in December 1929, May 1930, and May 1931 included the following question:

In what concrete ways does the child's interest in school activities seem to be affected by the use of the typewriter in your classroom?

The teachers' answers were classified in three groups: (1) in the first group were placed all answers which expressed a favorable judgment and which mentioned no unfavorable effects of any sort; (2) in the second group were placed all answers which expressed unfavorable judgments of any sort, even though they also contained some favorable indications; (3) in the third group were placed all answers indicating that the teachers had observed no effect of the typewriter one way or another; in this group were included also failures to answer.

Chart 33 shows the proportions of the 116 two-year Experimental teachers who gave favorable and unfavorable judgments of the influence of the classroom typewriter on the interests of pupils in December 1929, May 1930, and May 1931.

It is clear from Chart 33 that the great majority of the teachers judged on all three dates that the typewriter exercised a desirable influence on the interests of the children in their school work. Only one or two of the teachers gave judgments which were classified as unfavorable on the first two questionnaires, and no answers were found

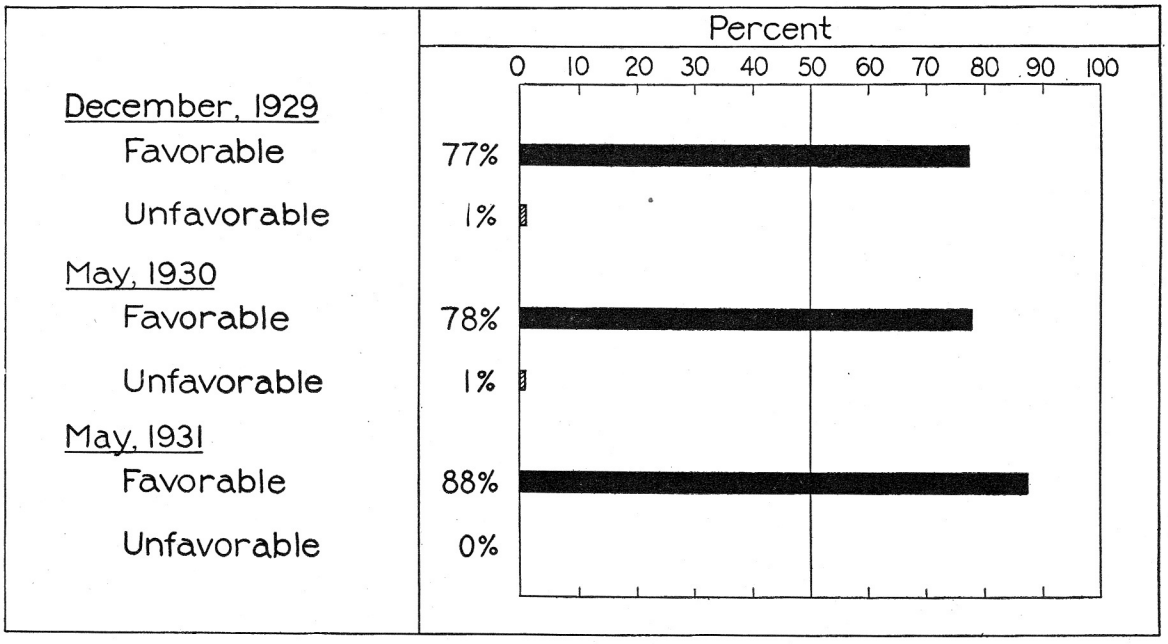


Chart 33. Teachers' Judgments of the Influence of the Classroom Typewriter on the Interests of Pupils

The long black bars show the proportions of teachers that judged the typewriter had favorable influences; the short cross-hatched bars show the proportions of teachers that reported unfavorable influences. The chart is based on returns from the questionnaires answered in December 1929, May 1930, and May 1931, by the teachers who had two full years of experience with the classroom typewriter. The percentage of teachers that failed to answer is the difference between 100 per cent and the sum of the percentages of favorable and unfavorable answers as shown on the chart.

on the last questionnaire which could be classified as unfavorable. The proportion of teachers expressing favorable judgments increases as their experience with the classroom typewriter increases.

The Experimental teachers mention many types of evidence in support of their judgments that the typewriters increase the pupils' interest in school work. In order to indicate the concreteness of the observations on which some of the teachers have based their judgments, we present in the following pages a list of the most important types of evidence cited by them, and under each type we reproduce without comment excerpts from answers of teachers that mention that type of evidence. Each excerpt is preceded by the abbreviation " Kdg." for kindergarten, or by an Arabic numeral 1 to 6, to indicate the teacher's grade. All the illustrative answers reproduced are taken from the May 1931 questionnaire.

Pupils come to school early and stay late. Among the most objective kinds of evidence mentioned by the teachers is the observation that many children in all grades come to school early, stay in during recess, and stay after school hours, in order to finish old projects or begin new ones under the stimulus and with the aid of the typewriters.

2 As a toy to make possible some creative impulse, the typewriter lures before and after school as well as in working hours.

2 Many are eager to begin typing the minute they enter the schoolroom.

2 I have children that want to stay after school to do extra work on the machines.

3 Children like to get to school early so as to use typewriters before school begins.

3 Children dislike to leave our school to go to a school that does not have typewriters. Mothers come and inquire if child can be put in room where there are typewriters when he is to be transferred.

5 If one group happens to be typing, and someone is absent, every child wants to take his place.

6 Pupils beg to come early to use typewriters; also to stay after school.

Wider participation in school activities involving writing. Many teachers report that a greater interest in school activities is evidenced by more writing, done with the help of the typewriters, for class or school newspapers, writing of more notices, invitations, letters, labels for exhibits, signs, ballots, grocery store tags, etc.

Kdg. The children are constantly typing words that are related to the school activities — in many of their activities the need for writing arises, such as in signs, invitations, their own names, etc., — the typewriters are an interesting and *successful* way of filling that need. Hence a fuller and greater interest in the activity, whatever it may be.

Kdg. Letter writing means more to the children when they can type their letters. Spelling loses much of its drudgery — it is so closely tied up with typing.

1 Each individual wants to tell his news and type it for the newspaper. At first this number was small — now each wants his part typed and put in.

1 The children suggest and carry out many more language and reading activities (letter writing, making books, etc.) than they ever did without the typewriters.

3 I notice an increased desire to do; the children type for the newspaper; they type poems; they write up and type club notes. Labels made for exhibits.

5 Desire for a newspaper grew from use of typewriter.

6 Interest in school activities has been motivated by the use of the machines. Children, with the exception of a few, enter gladly into any project suggested and often work up some of their own. Class papers, class booklets, parent-teacher notices, notices of various meetings, letters to parents, etc.

More original writing. One of the most significant contributions of the typewriter, according to the teachers, is that it provides an easier means of self-expression, thus enabling the child to realize a larger proportion of his creative impulses. A great number of teachers say over and over, in various contexts, that, with the aid of the type-

writers, their children compose and write more original material of various sorts, with more interest, greater satisfaction, and less effort than by handwriting. The teachers mention all kinds of writing, from original stories and poems to booklets of original arithmetic problems.

1 My children have a much greater interest in making up stories and poems if they can type them afterwards and illustrate them.
1 The machines speed up original English work. Original stories can be typed faster than they can be written.
2 There has been an unusual interest in writing stories and poems on the typewriter. In the past I found that very often children were not equal to the task of laboriously handwriting stories. The task of writing these stories on the typewriter seems so much lighter and the stories so much more satisfying to the child.
2 More original work is done by machine than by handwriting.
2 There is a larger field for the written story in younger grades.
3 I am sure that more has been accomplished in the matter of self-expression and original work by children of third grade age during these two years of experimentation with the typewriters than I ever witnessed before through a decade of experience.
3 A book of original arithmetic problems has been typed in my class.
3 The children enjoy copying and making up poetry.
4 The children are enthusiastic about writing stories and poems based on previous reading of legends, fables, and poems. History and geography form background for stories and letters.
5 The child's desire to communicate his immediate interests at home and at school by typing them has been evident.
5 It has aroused the desire to write original compositions and poems. The typewriters give the children a splendid chance for self-expression.
5 An interest in spelling; in longer sentences and stories; in letter form. A stronger desire to express what he has been doing.

More reading and research. According to some teachers the release of imaginative energy and creative impulse effected by the typewriter is further evidenced by more extensive independent and self-initiated reading on the part of the children.

1 Often a child will slip away from the library with a book and copy quite a bit on the typewriter.
2 My pupils show an active desire to learn to read in order to have something to type.
2 I have noticed a much greater interest in reading library books in school and taking books from the public library to find material pertaining to the unit of work we are doing. Children read for content rather than just look at pictures. Children seem capable of doing much more difficult work, especially in language.
3 More outside material brought in for benefit of class.
4 In my class there is more searching for new material, greater length of work, great variety of original work, greater amount of work accomplished.
5 The bringing in of outside material to be typewritten for benefit of class has increased. Often a child has not wished to have a special topic in some subject, but when told he may type it, his attitude has changed at once; thus it has created a spirit of greater willingness. A building spirit has been aroused in typing the news of the different rooms in our newspaper.
5 Children are more interested in looking up facts outside of school, knowing that they can type them. There is enthusiasm to type from dictation, while the remainder of the class is writing from dictation.

More written practice work. Many teachers report that the typewriters have notably reduced the drudgery that ordinarily attends much of the written work of pupils. They report much more practice, with less effort and more satisfaction, in typing over and over again, usually in neat columns, words and sentences for spelling, vocabulary, and grammar drill, fixing correct forms of speech and writing, distinguishing between different words spelled alike or pronounced alike, etc. Not the least important of the disagreeable routine tasks made more pleasant for both teachers and pupils is that of testing. Some teachers availed themselves of the presence of the typewriters for giving more and longer objective tests

of the multiple choice, true-false, matching, and completion types.

1 Tests can be given earlier with the typewriter, and more often, and with less trouble.
2 A very noticeable outcome is interest in study through repetition, as made possible in writing the same word or sentence several times.
4 Children enjoy using typewriters. *They do many otherwise disagreeable tasks more willingly if they can do them on the typewriter.* Most of them will write more, and better material, on the typewriter.
5 Increases interest in written work, especially drill work.
5 Certain work which would be considered drudgery when written is attacked with interest when typed.
6 Interest is prolonged in repetition or practice work.
6 They are willing to type plays, copy songs, and do things of that kind that were a hardship when everything had to be handwritten.

Improvement motivated. Several teachers report that the typewriter has served as an incentive for improvement in drawing, painting, handwriting, and other subjects. The availability of the machines for informal use during free periods is widely noticed as a wholesome influence on the pupils' initiative in all subjects. The use of the typewriter as an open reward, and the prohibition of its use until " standards are met," are reported by a few teachers; while such methods seem unwise and unnecessary to us, we report them here for the sake of the record.

Kdg. There seems to be an increased desire to paint, draw, and cut out pictures, so as to be able to type legends and paste them underneath the pictures.
1 An eagerness to make drawings good enough for a large book with typed stories. Delight in sketching growth of seeds with typed explanations for Garden Book.
1 Also the typewriter has created more interest in drawing. This was evidenced by the splendid drawings of toys in a toy book made by the class with a two-sentence composition typed by each child under his drawing.
1 I do occasionally have to deny a child the privilege of typing when he neglects his other work.
2 A child whose papers were habitually untidy was stimulated to overcome his careless habits, when as a reward for a neat paper, he was allowed to copy it on the typewriter.
4 Any free time may be used at the typewriter, hence there is a desire to finish assigned work in a minimum amount of time.
5 Poor writers like to use machines as papers look better. Some have worked very hard on handwriting so as to use the typewriter after they have improved handwriting.

The shy or slow child often " reached " by typewriters. Many teachers, notably in kindergarten and the early grades, report that the typewriter has been instrumental in " bringing out " some of their shy, shut-in, non-coöperative, and slow pupils. By providing these children with something they *can* do, and which the children themselves can compare with objective models, the typewriters help to achieve social as well as intellectual release for them.

Kdg. One child who started late in the year has found comfort in the typewriter because it is something he can do as well as other children, and because he has learned to print his name.
Kdg. Some very quiet and shy children have found great joy in the use of the typewriter.
Kdg. Shy children are forced into interested attitude, despite themselves; they become participating members of the group sooner. Keener, more all-round participation.
Kdg. Many uninterested children become interested in the machines, and then in school work sooner than they would if they had not had the machines.
Kdg. Any new child, bold or shy, discovers the typewriter as a new toy and rejoices in being able to accomplish something. The shy child feels his power and becomes one of the group.
1 I have noticed an aroused interest in slower children (not the slowest). They began to typewrite to keep up with the others and soon got power in it, and picked up in their reading too.
2 "Discipline" children are very often interested in using the typewriter.

2 Children who would be inattentive often are interested and want to type. They can make a good-looking paper and enjoy showing it to their friends; get pleasure and satisfaction.
6 A great influence on slow pupils. More creative work was done by dull pupils as they wanted to contribute towards the group. I have typewritten compositions written by children who could not compose before.

Neatness and print-like character of typing a boon to young pupils. A majority of the teachers in all grades mention the joy and satisfaction and encouragement that pupils derive from their ability to produce, with the aid of the typewriter, neat, clean, and legible pages of writing. For the very young children especially the ability to make it " look just like the book " is an incredible wonder and joyful stimulus; while with the older pupils the increasing neatness of their writings is a continuing inspiration.

1 The children get much pleasure and satisfaction in being able to produce a good-looking paper, and they are able to do this with the typewriter. The small children say, "It looks just like the book," or "like what the teacher puts on the board."
2 For the majority of the group the interest in school activities is stimulated by the use of the typewriter. For many children it is a neater way of working.
3 Interest is increased in all activities: (1) by variety of work he does on machines, (2) by appearance of papers when they are well done. (Great pride taken in appearance of work.)
4 Increased interest evidenced: (1) in producing a good-looking piece of work, (2) in completing the job undertaken, (3) in reading original papers to the class, so that all may share.
5 A neatly typed and well-arranged story in a notebook has inspired pupils to want to excel with their notebooks. Stories are often copied over because of pupil's dissatisfaction with work, the suggestion not coming from the teacher.
6 Unless a child is unusually gifted in the art of handwriting, he sometimes becomes discouraged with the appearance of his paper. However, when the typewriter is introduced, he stands a fair chance in the race for neatness.

Compactness of typing enhances project work. The compactness of typed matter and the adaptability of typed legends and titles has enhanced the interest and satisfaction of pupils in making all kinds of illustrated books, and in preparing and labeling exhibits. According to the teachers, this advantage is especially noticed in the kindergarten and early grades where the unusually large dimensions of the letters made by the very young children make the labeling of objects and the writing of adequate legends very difficult because of space limitations. The children, no less than the teachers, are keenly aware of the space problem, as will be seen when we come to analyze over three thousand letters written to us by them (see Chapter IX).

2 The compact form makes illustration more feasible, and thus encourages the making of booklets.
2 Labels, descriptions, lists, etc., are typewritten to accompany exhibits placed in the "Exhibition Case."
2 The children typewrite the class newspaper.
3 The children typewrite labels or tags for articles we have made.
3 The typewriters are especially desirable for labels for paints, stories that tell of work being done on building unit, plans of work, and lists of materials needed for building.
6 My 6A class works out ballots for elections in their Civics Club, using the typewriter. They feel quite grown up to use a "printed" ballot. They do their committee work on the typewriter. They type the names of good and careless pupils in care of desks; these are posted on bulletin board. In similar ways the machine is used to advantage in keeping up interest.

Children attracted by the typewriters as beautiful and interesting mechanisms. All the Experimental teachers have noticed and commented upon the extraordinary fascination which the machines have for the children. The appeal of the typewriter as a concrete object which can be purposefully

manipulated, or as a complex of mechanical niceties which can be " looked at and played with," is rivaled by the aesthetic attraction of the machine in its bright and pleasing colors. Some teachers report that the immediate naïve interest in the typewriter is often transferred to other school activities, particularly to those in which writing is involved.

Kdg. The child likes to use the typewriter for the purely manipulative exercise it affords.
1 The interest in the typewriters carries over to other activities, and makes the schoolroom itself seem an interesting place. Visiting children and parents are always attracted by the machines.
4 The typewriter has never ceased to interest the pupil. Any activity in which the machines are used is taken up with more interest and pleasure because of their enjoyment of the machines.

Children's " success " with typewriters maintains their interest. The immediate interest of the children in the typewriter as a novel and beautiful mechanism is in itself valuable, but of far greater educational significance is the fact, reported by many of the teachers, that the children's interest in typewriting is persistent and increasing. Some of the teachers who have used the classroom typewriters two years say that the " novelty " was very great, often obtrusive, at first, but that it was soon informed with or displaced by a more substantial and profound interest, having its roots in an inner consciousness of " success " at the machines, and augmented by a continuing satisfying sense of accomplishment. According to these teachers, the typewriter, especially in the kindergarten and early grades, provides a feasible means for satisfying educationally valuable impulses; the children can not only " do things " on the typewriter, but they can see for themselves that they can " make " letters, words, sentences, etc., " look just like the book." They do not have to be told when their work is good, they can see when their work fits the models. Children in the Typewriter classes have " dared " to compare their writing with that of adults, of their own teachers. One child told a visitor that he could write " prettier on the typewriter " than the teacher could on the blackboard. According to some teachers, the sense of accomplishment increases with many children as they use the typewriters more and more, because with the added practice their speed increases, while their papers become visibly neater and more like the models and books. The increasing length of the papers which they write in a writing period of given length, and the greater variety of written work which they learn to do at the machines, are also crucial factors in maintaining the satisfyingness of their work with the machine and of their interest in the school activities associated with it. The following excerpts from teachers' answers suggest that the classroom typewriter favors an essential condition for learning which has been justly emphasized by many schoolmen, and aptly summarized by Professor Kilpatrick in the phrase " persistent successful endeavor."

Kdg. The *success* he is able to attain with a typewriter is very different and very much greater than with almost any other form of activity in which he engages. Many children take great pride in having fine-looking papers. They are willing to do several papers in order to get one that is right or nearly so. Such pleasant and favorable reactions carry over into other experiences.
Kdg. Interest in typing never flags, and is not outgrown, as is the case with some materials used in the early part of the school year.
Kdg. The typewriter is not difficult for the child to manipulate.
1 The children's interest has never ceased, from the moment they were given the machines.
1 The use of the typewriter has held the child's interest constantly. Practically all are as keen to use the machine today as they were the first day it was brought in.

1 Most of the children never seem to tire of typewriting.
2 Children seem to enjoy typewriter as a plaything — they want to typewrite everything and anything — never tire of it — so interest in any activity is spontaneous and ever new.
3 In several instances children have done a finer piece of work on the typewriter than they had ever done in writing by hand. The joy of having accomplished something better has often inspired the child to do better work in spelling, story writing, and sentence structure.
3 The girls and boys are eager to try work on the machines, which I know they would not attempt with pencil or pen.
4 The young pupil seems to take great satisfaction in knowing that he is able to use a machine.
4 I feel that more creative work has been undertaken and accomplished, partly due to satisfaction of typing it and equal satisfaction in having it in typewritten form.
4 No matter what is done, the children want to "write about it." The children see the possibility for writing in almost every activity of the schoolroom.
4 By the use of the typewriter interest is stimulated and more sustained. This is especially valuable in tests, where the child's interest is noticeably hard to secure and to maintain. Written work is a pleasure with the machines, where it used to be a drudging chore.
4 The typewriter is something different, a novelty which two years of experience fails to dim the attraction of. Any work to be done on it ceases to be work and becomes an enjoyable activity.
4 Interest is quicker and keener and more constant.

The Typewriter and the Pupil's Attitude toward School

The questionnaires answered by the Experimental teachers in December 1929, May 1930, and May 1931 included the following question:

In what concrete ways does the child's attitude toward school activities seem to be affected by the use of the typewriter in your classroom?

Chart 34 indicates that the great majority of the teachers judged on all three dates that the typewriter exercised a desirable influence on the attitudes of the children. Only two or three of the teachers gave judgments which were classified as unfavorable in the first questionnaire; and no answers were found in the last two questionnaires which could be classified as unfavorable. The proportion of teachers expressing favorable judgments increases as their experience with the classroom typewriter increases, except that in May 1931 some teachers failed to answer the question on attitude because they considered that their answers to the question on interest would suffice for both questions. The complete absence of negative judgments in the last two questionnaires is significant.

The types of evidence cited by the teachers to support their judgments will now be listed and illustrated as in the preceding section on children's interests.

General morale of pupils improved. A majority of the teachers report a marked improvement in the morale of their pupils. The general attitude of their pupils is visibly more constructive, being characterized by a greater activity, more hopefulness, less discouragement, and less discontent. The children manifest a type of persistence in their written work which, to many of the teachers, is so unusual as to be quite noticeable.

The better morale indicated by these observations is associated, according to many teachers, with the fact that the typewriter affords a means of expression that is really effective. With the machine even very young children can really write. It makes possible immediate and visible fulfillment of initiative and creative impulses at an age when the imaginative activity of children is very great, and when positive expressive conditioning may produce the

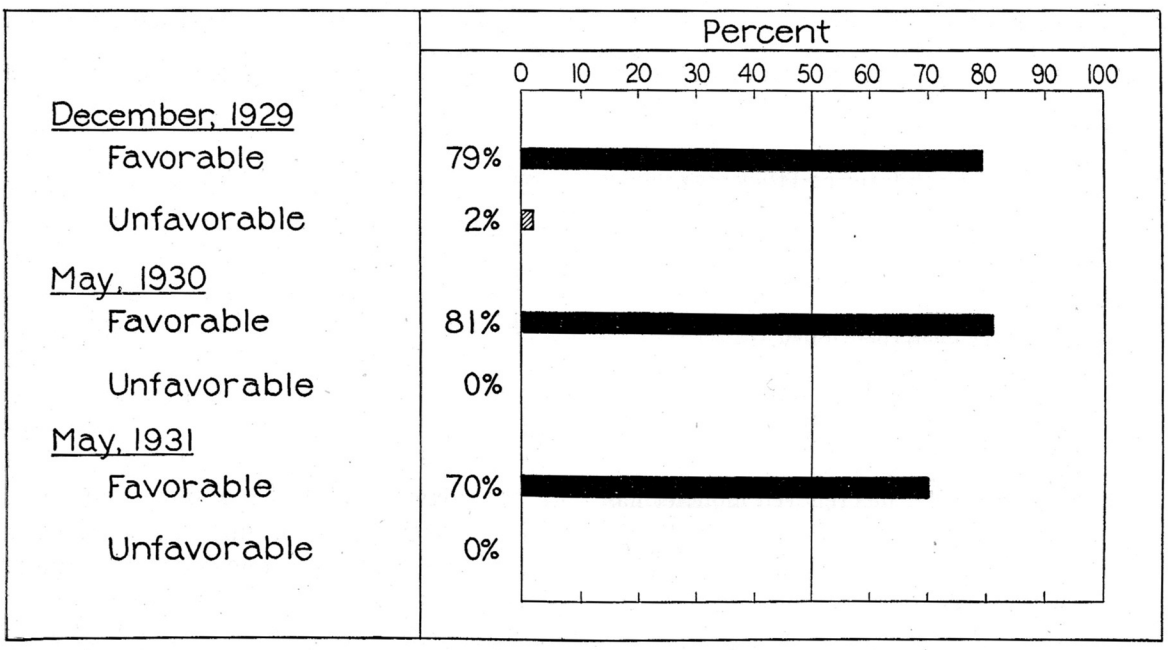


CHART 34. TEACHERS' JUDGMENTS OF THE INFLUENCE OF THE CLASSROOM TYPEWRITER ON THE ATTITUDES OF PUPILS

The black bars show the proportions of teachers that judged the typewriter had favorable influences; the short cross-hatched bar shows the proportion of teachers that reported unfavorable influences. The chart is based on returns from the questionnaires answered in December 1929, May 1930, and May 1931 by the 116 teachers who had two full years of experience with the classroom typewriter. The percentage of teachers that failed to answer is the difference between 100 per cent and the sum of the percentages of favorable and unfavorable answers as shown on the chart.

most constructive activity habits and attitudes.

Kdg. It is another inducement to come to school. A few children like school better because of it. It offers a more effective and satisfying means of expression for the advanced child.

1 The typewriter seems to create a desire "to do." In creating this desire the child has a different attitude towards school.

1 There is much more alertness, initiative, and interest — also confidence in attacking all activities. Greater persistence and joy in the way they work.

1 Much of the drudgery of writing has been eliminated by this interesting process and more interesting material supplied, and school has become a happy place in which to work and play. Much of dull drill has been replaced by "doing something," and learning results naturally. Visitors always remark on the busy atmosphere persisting without pressure from the teacher.

1 All children, even the slower ones, take pleasure in the fact that here is something each one can do well. Some children who do not seem to be able to make contributions to class activities in any other way have succeeded in supplying a well-typed paper and thus have received praise and have experienced success.

2 The fact that there is some way of expressing himself satisfactorily in writing has been a tremendous factor in giving encouragement, especially to those whose scholastic ability is not particularly high.

2 Since work is easier and more creditable looking when typed than when handwritten, the dull child takes satisfaction in his production as well as does the bright child. Through this satisfaction ambition is fanned and a desire to create and compose is fostered. The children would be heartbroken should they be forced to give up their machines.

2 It gives the brighter child more scope and means for doing creative work. It

serves as a stimulus for drill for the slower children.

3 The children seem freer in expression in written work — that is, they do not seem to tire as much as they do in writing in long hand. The finished product looks better to the children and they are prouder of their typewritten work.

3 The child is more eager to participate — has great pride in ability to use the typewriters. Many of them who type rapidly seem to consciously challenge the teacher to keep them busy.

4 The children seem to consider a lesson less of a task if it can be done on the typewriter. They often do willingly on the typewriter tasks they seem to dislike if they are obliged to write them.

4 The typewriter has relieved monotony of handwriting all written work and inspired children to undertake more creative work.

5 A large percentage of pupils in Fifth Grade English who dislike the mechanics of handwriting will cheerfully do their written work on the typewriter.

6 In some cases work which would otherwise seem irksome is attacked with more willingness if the typewriter may be used.

The typewriter promotes self-criticism on the part of pupils. Many of the teachers say that the pupils are able to recognize their mistakes more readily when their writings have been done with the aid of the typewriter. The pupils can compare their typewritten papers with authentic models more objectively; errors and discrepancies tend to stand out so clearly that the pupils tend to acquire almost unconsciously an attitude of self-criticism and carefulness in their work.

Kdg. Because they can readily recognize their mistakes, the children acquire more careful attitudes in their work.

4 There is more interest in the finished form for written materials and reports.

5 The children strive for neater and more perfect work.

5 I think the best result the machine has helped to bring about is the desire to make good-looking and well-arranged papers, whether they be stories, poems, etc.

5 The children all show great pride in their accomplishments. There is a certain amount of competition, each trying for the finest paper.

6 Some children are more willing to correct papers and to work if they can use the machines.

The typewriter promotes good working habits and attitudes. The teachers comment extensively on the more serious and purposive attitude of the children when working at the typewriters. Some of them say that after the first excitement over the brightly colored machines has subsided, the children soon come to feel that the typewriter is a " real thing " which is important in the grown-up world about them, and which is visibly and immediately useful in their school work. A considerable number of teachers say that the typewriter helps create good working habits, promotes habits of persistence and concentration, and helps to establish a habit of independent study.

Kdg. The typewriter is a real, honest-to-goodness thing. It has no element of patronization or sentimentality. It is what men and women use to "earn money" in the world of reality.

1 Children seem to have gotten the desire to finish everything they begin, since each typewritten lesson is in itself a small project and they are never satisfied until each one is finished. This carried over into other lessons.

1 The typewriter helps to create good working habits. Children will very often get their seat work done in less time when they want to use the typewriter. Will want to hurry and finish their reading charts so they can type them.

2 Many pupils in my grade lack concentration. The use of the typewriter gives them most valuable training in that respect.

2 When they want to use the typewriter, children seem to work faster and get assigned work done in less time. Helps to create good working habits.

3 Greater amount of independence shown in work.

5 The typewriter sometimes changes dislike to liking for a subject. A child never objects to writing a piece of work over again if it is to be done on the typewriter.

The typewriter promotes attitude of responsibility. The typewriters, being obviously valuable pieces of equipment which require conscientious care, present many opportunities for the development of a sense of responsibility. Several teachers have reported that the responsible attitudes developed by the individual and coöperative care of the machines in the classroom have been manifested in better care of school equipment in general.

1 The typewriter improves his attitude by increasing his care of other equipment; makes him more careful and more diligent because he wishes to contribute to all the activities being carried on.
1 As we have tried to keep the machines for use by those who were good workers and good citizens of the class, the typewriter has helped to keep up our standard.
1 The children show a sense of social responsibility by saving each other's papers carefully when one takes the place of another who has not finished a piece of work.
1 I notice an awakening sense of responsibility; the children remember to put away typewriters and leave office in order; they are pleasant and polite in choosing helpers; office boy, manager, etc.
3 There is evident appreciation of the typewriter as a valuable piece of equipment that requires care.
6 The typewriter develops greater sense of responsibility in caring for property. Pupils work hard to be selected monitor to care for distributing machines.

The typewriter develops self-confidence in slower pupils. Quite a number of the Experimental teachers have observed that the ability of the slower children to express themselves with the aid of the typewriter tends to change their whole attitude in the classroom; they become more coöperative and happier and tend to lose their inferiority feelings.

1 Dull children who have been able to do neat work have received more respect from the group.
3 Slow children contribute more to group activities through use of machines. (Making booklets, newspapers, etc.)
4 Inferiority feelings that sometimes occur in the slower children seem to be overcome.
4 Slow children are proud when they finish a bit of typewriting.
4 It seems to take an interminable time for slow children to finish a typed paper, but they seem more eager to complete the job.

The Typewriter and the Social Atmosphere of the Classroom

The following question was included in the questionnaires answered by the Experimental teachers in May 1930 and May 1931.

In what concrete ways does the social atmosphere in your classroom seem to have been affected by the presence and use of the typewriter?

The answers of the teachers to this question were classified in the same way as their answers to the questions on the interests and attitudes of the pupils, with the results shown in Chart 35.

Between 75 and 80 per cent of the teachers on both dates report that the classroom typewriter had a favorable influence on the social atmosphere in their rooms. In May 1930, five of the 116 teachers reported unfavorable influences on the classroom as a social unit. The conditions reported by three of these five teachers were due to the over-eagerness to write on the typewriters and the lack of restraint of some of their children. At the end of the second year of the experiment, none of the 116 teachers reported any unfortunate influences of the typewriters. The types of evidence given by the teachers who gave favorable answers are listed and illustrated in the following pages.

The typewriters promote coöperativeness and mutual helpfulness in the classroom. That the classroom typewriter provides many genuine opportunities for practice in coöperativeness and mutual helpfulness under natural and non-artificial conditions

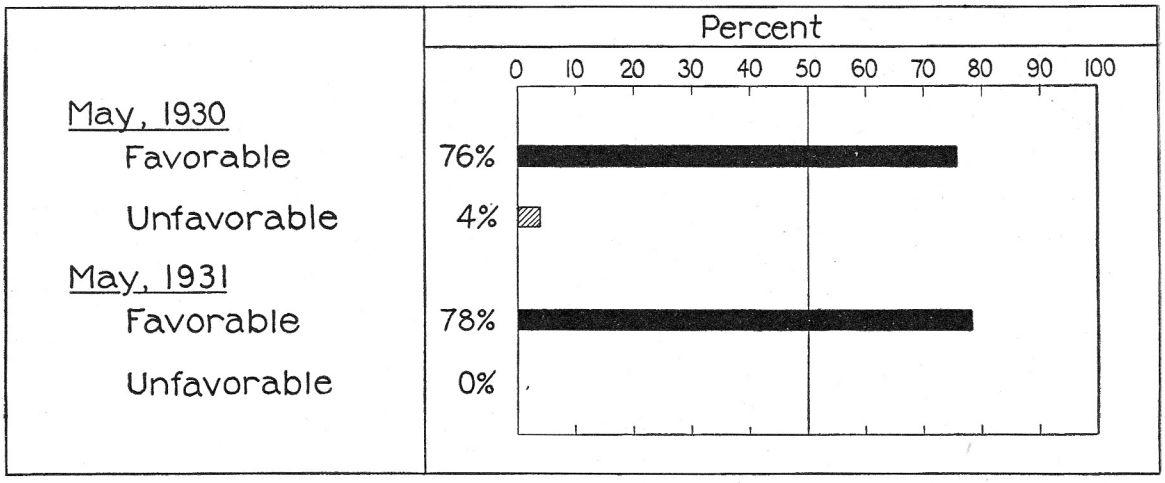


CHART 35. TEACHERS' JUDGMENTS OF THE INFLUENCE OF THE CLASSROOM TYPEWRITER ON THE SOCIAL ATMOSPHERE IN THE CLASSROOM

The black bars show the proportions of teachers that judged the typewriter had favorable influences; the short cross-hatched bar shows the proportion of teachers that reported unfavorable influences. The chart is based on returns from the questionnaires answered in May 1930 and May 1931, by the 116 teachers who had two full years of experience with the classroom typewriter. The percentage of teachers that failed to answer is the difference between 100 per cent and the sum of the percentages of favorable and unfavorable answers as shown on the chart.

is noticed by many teachers. In support of this judgment the teachers cite many specific types of conduct: the pupils discuss with each other the work to be done on the typewriter; they compare and judge each other's work; they help each other spell words and find new words; they help each other at the typewriters, finding letters, capitals, shift lock, carriage return, etc.; bright children teach younger and slower ones; the children dictate letters to each other; each relay of children tidies the typewriter table for the next relay; the children are zealous to acquaint newcomers in the class with the typewriter.

Kdg. Children often discuss with each other what can be done with the typewriter; the different parts and their use; compare work; help each other unlock, remove cover, insert paper, etc. Learn to share use of machines and to take turns in typing.

Kdg. I oftentimes see a child helping another child to find letters; or showing him how to space. This shows good pupil-to-pupil relationship. Sharing the machines, evaluating the completed work and taking care of the machines have helped the children to work together as a social group.

Kdg. The presence of the typewriters has created a spirit of helpfulness. If one child has difficulty in locating a certain letter, the child next to him is eager to help him. If a child comes to a word which he does not know, he feels free to ask someone near him.

Kdg. Children help each other to find various letters; write each other's names; show each other how to operate the machines; converse with each other freely, while typing, concerning the mechanics of the machine.

Kdg. Children who are most capable with the machines are always eager to be helpful to new children or to less capable ones, in teaching them what they know. They are desirous of showing what they can do and of learning from the others also. Their enthusiasm over typing is very keen, and they share with each other what they have learned.

Kdg. Older children are willing and anxious to show their superior knowledge and help the new children.

1 There is much more conversation and exchange of ideas around the typewriters.

1 The children are very helpful to each other at the typewriters. The bright child delights in helping the slower child. The slower child is keenly interested in watching and imitating the bright child.
1 There is a fine spirit of helpfulness as the children help each other by dictating the letters to the typist if the assignment is long.
1 They are always eager to help newcomers.
1 A spirit of helpfulness and coöperation as well as courtesy has been developed.
1 Having only enough typewriters to accommodate a group of fifteen children at one time, they learned to take their turns. They learned to care for property properly; to help other children in their difficulties.
1 Sharing of machines and imparting of skills have helped in unselfishness.
1 The children have been very fair about taking turns and not wasting time at the machines.
2 Children of high ability, who are quick workers, are often seen helping the less talented children typewrite stories, poems, etc.
2 Helpfulness is always evident. A new pupil is always cared for and taught by many volunteers.
2 The presence of the machines engenders fairness in waiting for turns. There is politeness and helpfulness. Contributions to a community project give children a sense of helping in a larger way.
3 The social atmosphere of the classroom is affected by the presence and use of the typewriter. Children are quite charitably inclined toward each other. Particularly in respect to the less favored children is this noted. The children who do well in all phases of school work are glad to assist the ones who have difficulty.
3 Children help each other and especially when a new pupil comes there is kindness, helpfulness, and welcome.

The typewriters promote independence. We have seen in the preceding paragraph and quotations that many teachers have observed the socializing influence of the classroom typewriter as manifested by the greater coöperativeness and mutual helpfulness of the children. That this influence of the typewriter does not, however, tend to reduce the class to the status of "the herd" is attested by an equally large number of teachers. These teachers justly enlarge upon the great value of the tendency of the typewriters to develop habits of independence, of self-initiated and self-propelled effort, of concentration, of persistence, and of extensive self-criticism.

Kdg. The "goose-step" cannot survive in a typewriter-rhythmed room.
Kdg. Children become more self-reliant and coöperative. A feeling for the need of careful handling of materials is shown.
1 The typewriter helps to develop initiative in children. It brings out latent talents in the ability to compose and do original pieces of work.
2 Learning to care for machines that are used by the group is an important factor in bringing about the right social atmosphere. Helping each other is bringing about *independence* and coöperation among the individuals in the group.
2 The more capable children are eager to help others in gaining ability to type well. The typewriter makes for the development of deeper concentration.
2 The idea of all pupils "clattering" at the machines at the same time, in like or unlike work, is in itself socially stimulating.
3 The social atmosphere in the classroom seems to be favorably affected by means of the typewriters. It seems to be a very busy place when every child is doing something worthwhile which is of great interest to him. They are anxious to help each other also.
4 If one group is doing work at the typewriters and the other groups are doing something at their seats, the groups at their seats will work just as well as the children typing because they know they will get their turn at the typewriters as soon as their work is done well.
4 The use of the machines sometimes bothered those of last year's group who were not typing. This year's group does not seem to be affected.
6 There is more freedom in the room. More children are moving about. The classroom has an informal atmosphere.

The Typewriter and the Teacher

The typewriter and the teacher's time. Aside from the actual results obtained, one of the most important considerations concerning any classroom device or activity is the amount of time which it requires on the part of the teacher. In order to throw some light on this phase of the classroom typewriter, the following question was included in the questionnaire answered by the teachers in May 1931:

My experience with the typewriter has convinced me that its classroom use calls for extra time of the teacher to an extent which is (*a*) rather small, (*b*) fairly large, (*c*) excessively large.

The answers to this question of the 116 teachers who used the typewriters for two years are shown graphically on Chart 36.

Chart 36 shows that 92 per cent of the teachers, after two years of experience with the classroom typewriter, say that it involves little extra time, or only a fair amount of extra time on the part of the teacher. Seven per cent say that the classroom typewriter requires an excessively large amount of extra time on the part of the teacher. One teacher failed to answer the question. The fact that only 8 out of 116 teachers say, after two full years of experience under the burdensome conditions imposed by the experimental requirements, that the classroom typewriter demands more than a fair amount of time on the part of the teacher, gives us an indication of fundamental significance regarding the adaptability of the typewriter for classroom purposes.

The typewriter and the pleasure of teaching. The indications of Chart 36 are strengthened by the indications of Chart 37, which shows graphically the answers of the same teachers in May 1931 to the following question:

The classroom use of the typewriters renders the teacher's work (*a*) more pleas-

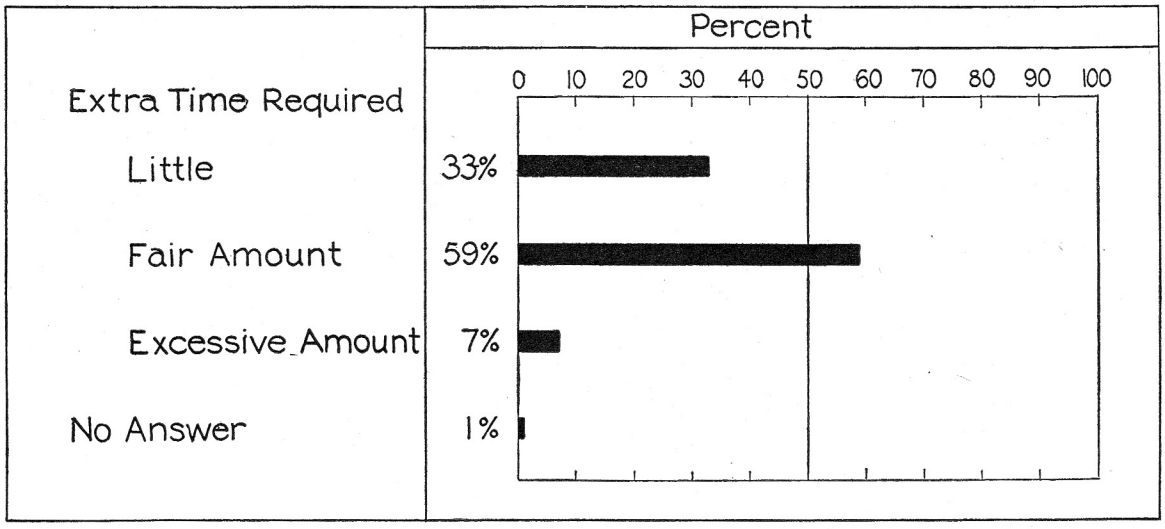


Chart 36. Teachers' Judgments on the Amount of Extra Time Demanded of Them by the Classroom Typewriter

The bars show the proportions of 116 teachers, who were in the experiment two full years, that chose ndicated answers in the following question in May 1931:

My experience with the typewriter has convinced me that its classroom use calls for extra time of the teacher to an extent which is:

a. rather small *b.* fairly large *c.* excessively large

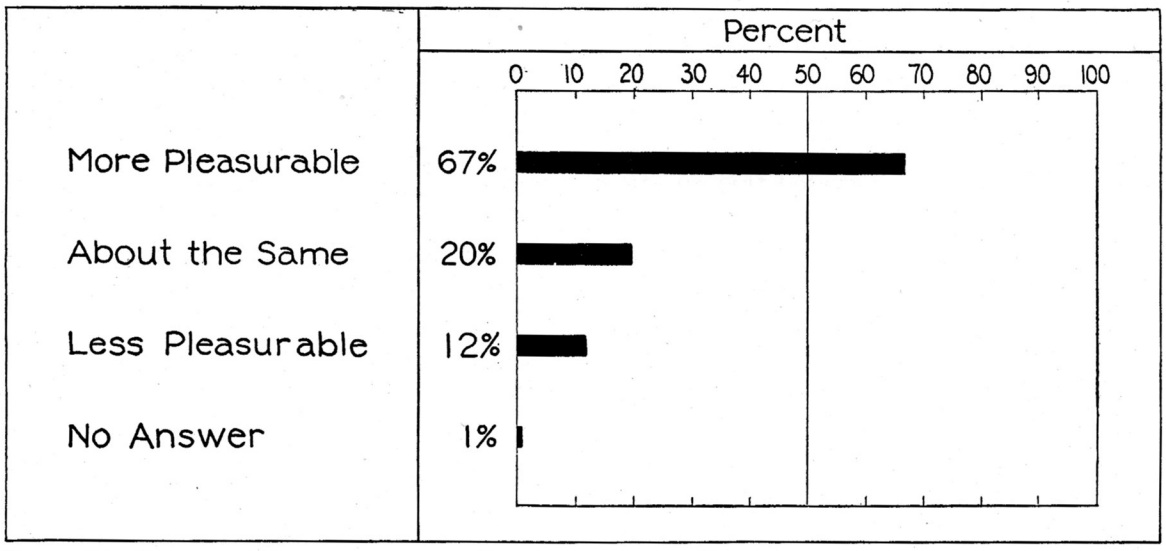


CHART 37. TEACHERS' JUDGMENTS OF THE INFLUENCE OF THE CLASSROOM TYPEWRITER ON THE PLEASURABLENESS OF TEACHING

The bars show the proportions of 116 teachers, who were in the experiment two full years, that chose indicated answers in the following question in May 1931:

The use of the classroom typewriter renders the teacher's work:
a. more pleasurable *b.* about the same *c.* less pleasurable

urable, (*b*) about the same, (*c*) less pleasurable.

Sixty-seven per cent of the teachers say that the classroom typewriter makes teaching more pleasurable, and 20 per cent say that teaching with the typewriter is as pleasurable as without it. Thus, 87 per cent of the teachers after two full years of experience say that teaching with the classroom typewriter is as pleasurable as or more pleasurable than teaching without it. Twelve per cent of the teachers say that the classroom typewriter makes teaching less pleasurable. A careful reading of the questionnaires of the teachers who found teaching with the typewriter less pleasurable reveals the fact that their unfavorable reactions are due to a considerable extent to unfavorable local conditions, and to the extra burdens imposed by the experiment, rather than to the work with the typewriter.

Teachers' recommendations regarding the classroom typewriter. The following question revealed the fact that 85 per cent of the Experimental teachers at the end of the first year wished to participate further in the typewriter investigation if it should be continued:

If the investigation is continued beyond this year, I should wish (*a*) to participate further in it, (*b*) to withdraw from it.

Only six per cent of the teachers wished to withdraw, and nine per cent failed to answer the question. These percentages hold for the total group of 158 teachers who answered the questionnaire, and for the group of 116 teachers who were in the experiment two full years. It was this evidence of the teachers' desire to continue the experiment, together with the recommendations of the superintendents, principals, and headmasters, that enabled us to secure the second grant of funds described in Chapter I.

At the end of the second year the following question was asked:

From my experience of the past year or two I would (*a*) recommend the typewriter for use in my grade, (*b*) not recommend the typewriter for use in my grade.

Eighty-seven per cent of the total group of 166 teachers who answered this question in May 1931 said they would, and 12 per cent said they would not recommend the typewriter for use in their grades. One teacher did not answer the question. Thus it appears that 85 per cent of all Experimental teachers in the first year, and 87 per cent of all Experimental teachers in the second year, recommend the use of the classroom typewriter in their several grades.

If, however, we confine ourselves to the answers of the 116 teachers who had two full years of experience, it appears that 85 per cent of them are willing at the end of the first year to continue in the experiment, and at the end of the second year, 93 per cent of these same teachers categorically recommend the use of the classroom typewriter in their several grades. One teacher failed to answer the question, and seven of the 116 said they would not recommend the typewriter for their grades. These figures are shown graphically in Chart 38.

That 93 per cent of the teachers who had two full years of experience with the typewriters in their classes, under the burdensome conditions of a rigorous experimental procedure involving many onerous tasks, should make a categorical recommendation in favor of the use of the typewriter seems highly significant.

The reasons given by the seven two-year teachers for not recommending the classroom typewriter for use in their grades, and the general tenor of their answers to the other questions on the questionnaires, are very illuminating. All of the seven teachers cite several favorable influences of the classroom typewriter on the interests, attitudes, and achievements of the pupils, and five of them are highly impressed and even enthusiastic about the educational values of these influences. Two of the teachers, after underlining the answer "would *not* recommend," added the qualification "unless each pupil has a machine." Another teacher, whose answers to the rest of the question-

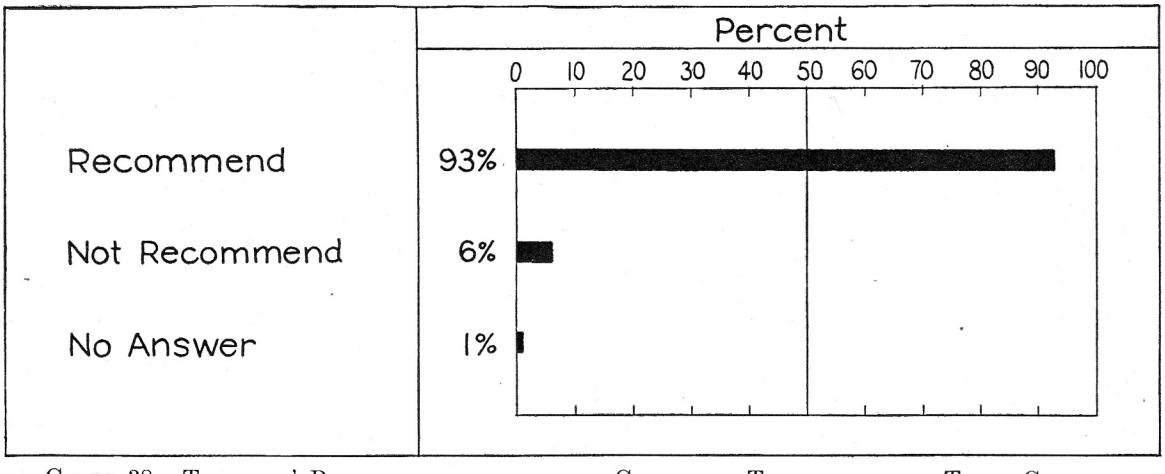


CHART 38. TEACHERS' RECOMMENDATIONS OF THE CLASSROOM TYPEWRITER FOR THEIR GRADES

The bars show the proportions of 116 teachers, who were in the experiment two full years, that chose indicated answers in the following question in May 1931:

From my experience of the past year or two, I would:

a. recommend the typewriter for use in my grade

b. not recommend the typewriter for use in my grade

naire are highly favorable, has evidently taken the words " your grade " in the question to mean the class and room of which she was in charge during the experiment, since she adds this explanation to her underlining of the " would not recommend " answer: " because my room is too small — it was not intended for a classroom."

A fourth teacher cites many valuable results of the classroom typewriter, but says that each child should have a machine, and that instruction in typing as such should be done in scheduled periods, under expert typists, especially when the pupils first begin the use of the typewriters. The pedagogical implications of this thoughtful teacher's answers are discussed at length in Dr. Haefner's book.

A fifth teacher explains that it is "almost impossible to have satisfactory results with so large a group and so varied a program," and adds that " there should be someone in the room to help the children with their special difficulties — we cannot always do this." Another of these seven teachers, after noting that the classroom typewriter " aids in discipline, makes for self-reliance, provides a method of independent drill, helps in sentence work," writes: " My difficulties are: (*a*) How to follow my program and supervise typing at the same time (it can't be done); (*b*) filing and classifying the children's writings."

The last of this group of seven teachers cites many valuable influences of the typewriter, but gives no specific reasons for not recommending its use. A careful reading of her response to the whole questionnaire, however, indicates that her reasons are, like those of the other six teachers, involved with unfortunate local conditions, with the burdensome tasks imposed by experimental requirements, or with the particular ways in which the typewriters were introduced to and used by the children in her class during the course of this experiment.

None of these seven teachers fails to mention favorable effects, and some of them, as already noted, are quite enthusiastic about the helpfulness of the typewriters even under the untoward conditions in their classes which they describe. Their answers suggest the inference that under more favorable local conditions they would have made the adjustments which the great majority of the other Experimental teachers made without undue expenditure of time and effort, and with an increase in the pleasurableness of their teaching work. But these teachers were requested to base their judgments and answers on their own actual experience, not upon what " might have been " under more favorable conditions; and they have thoughtfully and conscientiously done so.

CHAPTER VII

TEACHERS' JUDGMENTS OF THE INFLUENCE OF THE TYPEWRITER ON ACHIEVEMENT IN INDIVIDUAL SUBJECT MATTERS

Introduction

At the beginning of the preceding chapter we discussed the importance and validity of the teachers' judgments, described the sources of the data on their judgments, and illustrated the various types of evidence and concrete observations which they adduced in support of their judgments regarding the general influences of the classroom typewriter. The data for the present chapter are derived from the same three questionnaires answered by the teachers in December 1929, May 1930, and May 1931; only the answers of the teachers who used the classroom typewriters two full years are considered; and the plan of presentation is the same as in the preceding chapter, all illustrative excerpts from the teachers' answers being taken from the May 1931 questionnaire.

The questions answered by the teachers were all of the same form, and emphasized the desirability of concrete observations rather than vague impressions:

What concrete effects has the classroom typewriter in your room had on *Spelling?*

In spite of this emphasis on concrete observations, the halo effect is prominent, and the reader should be on guard against it, throughout the teachers' answers summarized in this chapter.

Questions of the same form were asked on Reading, Composition, Geography and Nature Study, History and Citizenship, Arithmetic, Handwriting, Fine Arts, and Industrial Arts. The teachers' judgments will now be presented on each of these subjects in the order given, beginning with spelling.

The Typewriter and Spelling

Chart 39 shows that in December 1929, only three months after beginning the use of the classroom typewriter, 70 per cent of the teachers reported that they had observed favorable influences of the machine on spelling. In the last two questionnaires more than 80 per cent reported favorable influences. In the first two questionnaires only one teacher gives an answer which we have classified as unfavorable; none of the 116 two-year teachers reported any unfavorable influence in the last questionnaire in May 1931. The absence of unfavorable judgments in the last questionnaire, and the increase of numbers of teachers who observed positive influences with increased experience with the typewriters, are significant. The types of observations cited by the teachers in support of their favorable judgments will now be illustrated.

The typewriter creates "felt need" for spelling. According to many teachers in the kindergarten and early grades, the fact that the typewriter creates the possibility of writing arouses a compulsive interest in spelling and creates an active demand for spelling instruction. The motivation thus created is natural and spontaneous, based on an immediate felt need. Children do not need to be urged to learn spelling; they *force* the teacher and older children to teach them.

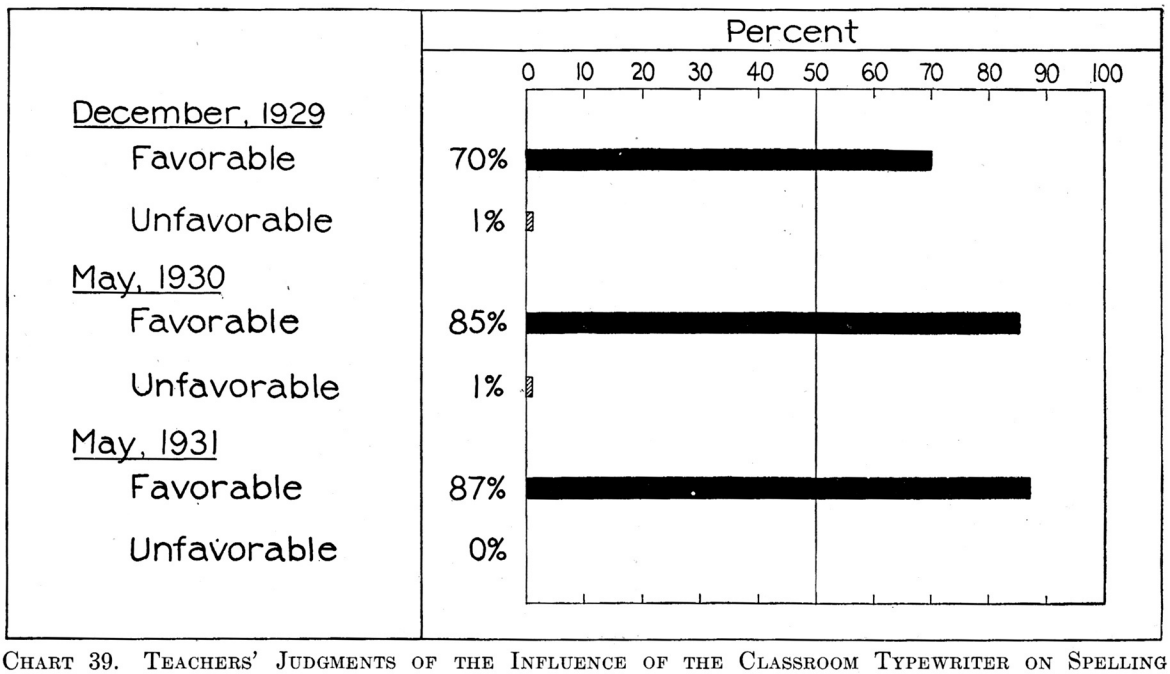


CHART 39. TEACHERS' JUDGMENTS OF THE INFLUENCE OF THE CLASSROOM TYPEWRITER ON SPELLING

The black bars show the proportions of teachers that judged the typewriter had favorable influences; the short, cross-hatched bars show the proportions of teachers that reported unfavorable influences. The chart is based on the returns from the questionnaires answered in December 1929, May 1930, and May 1931, by the 116 teachers who had two full years of experience with the typewriter. The percentage of teachers that failed to answer is the difference between 100 per cent and the sum of the percentages of favorable and unfavorable answers as shown on the chart.

Kdg. It is my opinion that the typewriters provide a situation that creates an interest in spelling and should facilitate the ability to spell. So often we hear "How do you spell ——?" The wish to type the word creates this question.

Kdg. Kindergartners gain half a year in spelling.

1 Creates a desire to spell at a very early age.

1 Children ask how to spell many more words.

1 Never have I had a class as interested and doing as well in spelling. They have learned all the letters and call them by name. They have simply *forced* spelling into our daily work by their enthusiasm, eagerness, and demand to spell.

1 Children, after the first step in typewriting, want to pick out words to write. First their names, then other names they know, animals, etc. They do learn to spell simple words.

1 The typewriters have helped to motivate spelling. The children realized their need for words in writing their stories and letters. Unconsciously they have learned to spell many words in their copying and in their letter writing.

1 We do not have spelling in first grade, but the children learn the letters from using the typewriters. They copy words in sentences and learn first from spacing that words have a meaning, then they see the letters and begin to recognize like elements.

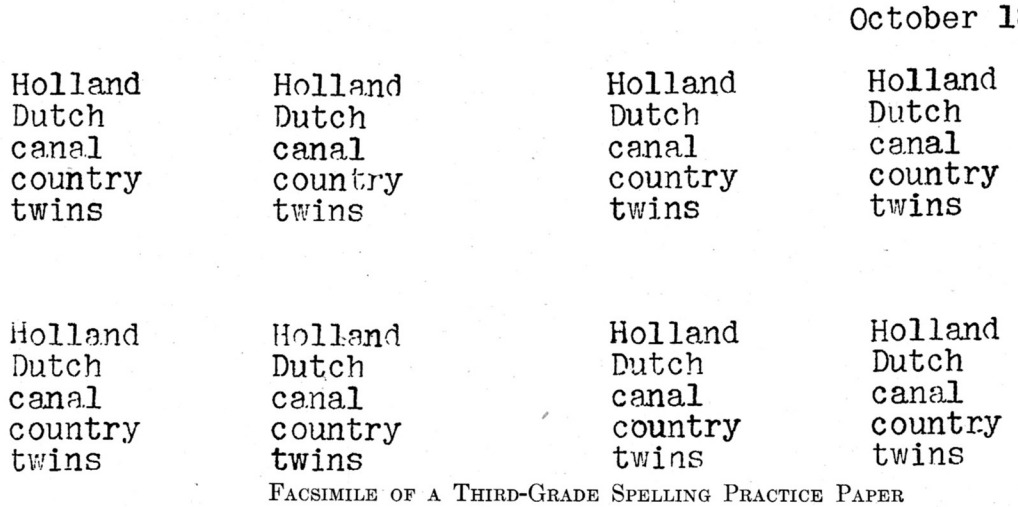
2 By using the typewriter it is possible to give the child more words, in less time than it would take to give them by hand. Also the composition work is a great aid in spelling.

The typewriter makes drill and practice exercises more effective. The ease of typing words and sentences over and over, in legible, compact, and neat columns, promotes much self-initiated practice, and tends toward automaticity in spelling most of the common words and many others which children would not ordinarily use.

long longer longest	low lower lowest	soon sooner soonest	
big bigger biggest	tall taller tallest	dark darker darkest	
small smaller smallest	short shorter shortest	light lighter lightest	
wide wider widest	cold colder coldest	quick quicker quickest	
happy happier happiest	warm Warmer warmest	clean cleaner cleanest	
large larger largest	hot hotter hottest	safe safer safest	
high higher highest	black blacker blackest	gray grayer grayest	

FACSIMILE OF A THIRD-GRADE WORD STUDY PAPER

The child wrote the three forms of 21 adjectives, spelling each word correctly. The typed words are as clear as book print. The lines were made on the typewriter after the words had been written.



October 18, 1929.

Holland Holland Holland Holland
Dutch Dutch Dutch Dutch
canal canal canal canal
country country country country
twins twins twins twins

Holland Holland Holland Holland
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country country country country
twins twins twins twins

FACSIMILE OF A THIRD-GRADE SPELLING PRACTICE PAPER

The pupil had used the machine for only a month. On this paper he obtained eight practices on each of five words. Each typed word has the perceptual clearness of book print.

Kdg. Repetition is easy and pleasant on the typewriter. Practice in typing the same word over and over in columns or in lines must surely be an aid to the child in visualizing the word and the letters that make up the word.

Kdg. The spelling of many of the more common words becomes automatic.

1 The writing of many simple words becomes automatic through the use of the typewriter.

1 Provides excellent voluntary drill.

1 Children master many little words with ease and in a way that seems natural and purposeful. Much drill on common words is possible without drudgery.

2 Children are using simple words over and over; many unconsciously learn to spell through using the typewriter.

2 Children who wouldn't otherwise study spelling willingly, do so by using the typewriter. Also the more advanced children make out supplementary lists.

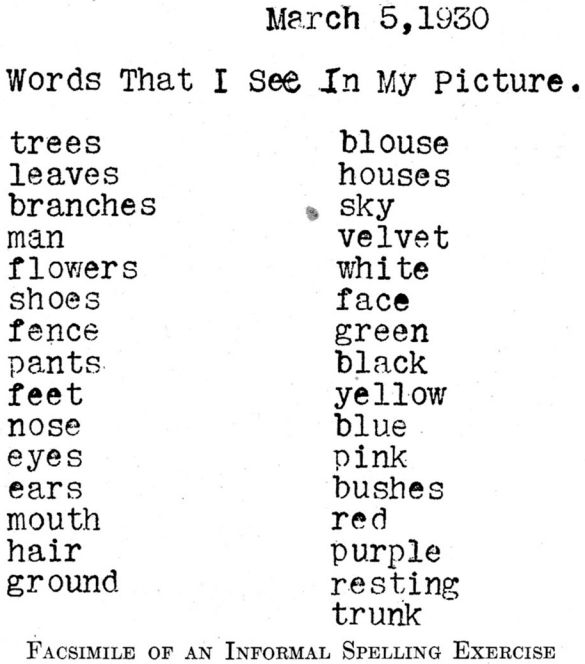
2 There has been a strikingly good effect along this line. More repetition has been possible and has made profitable study a pleasure. Much more ground can be covered in a single lesson and review work can be more speedy.

2 Typing adds to the number of spelling experiences.

2 Afford a delightful form of drill. I have pupils type a whole line of the same word. They enjoy the sense of proficiency they obtain in the increased speed they can maintain.

2 Children get extra drill in spelling. Enjoy typing word lists, and write original sentences using words studied.

3 Children have learned to spell mechanically and with little thought due to much repetition in typing.



March 5,1930

Words That I See In My Picture.

trees blouse
leaves houses
branches sky
man velvet
flowers white
shoes face
fence green
pants black
feet yellow
nose blue
eyes pink
ears bushes
mouth red
hair purple
ground resting
trunk

FACSIMILE OF AN INFORMAL SPELLING EXERCISE

This paper was prepared by a third-grade pupil. He studied a picture carefully and then listed all the words he could see in it.

April 3, 1931

1. peep
2. keeping
3. sleeping
4. period
5. crowd
6. sometimes
7. somewhere
8. lonely
9. lonesome
10. jelly

1. A chicken can peep.
2. She was keeping house.
3. I wanted to keep on sleeping this morning.
4. A period is like a dot.
5. I don't like to be in a crowd.
6. Sometimes I can't find a book to read.
7. It is somewhere around here.
8. I'm not lonely.
9. Don't be lonesome.
10. I like jelly.

A little chicken will peep when it comes out of the shell. I'm not keeping it. Is he sleeping again. Don't forget the period at the end of sentences. There was a big crowd there. Sometimes he works until twelve. He is somewhere. It is lonely here. Oh don't be lonesome. Grape jelly is made of the juice of grapes.

FACSIMILE OF A SPELLING EXERCISE

This paper was prepared by a fifth-grade pupil. The ten words were first written in column form. Two sets of illustrative sentences containing the words were then composed.

3 Furnishes extra drill as the children voluntarily copy lists of spelling words.
4 Enjoyable way of drilling on misspelled words.

The typewriter provides clear images of words. Nearly all the Experimental teachers mention, in one connection or another, the advantages accruing from the legibility and clearness of typed matter. They say that typing makes clear images of letters and words, and since these are "made" by the child in a purposive and self-active attitude, they reinforce the images which the children get from their printed books.

Kdg. Less emphasis has to be placed on the capital letters, the children have become so thoroughly acquainted with them. Children recognize the individual letters much sooner than they would otherwise.
1 Typewriting has aided greatly in teaching spelling, as the letters were learned in typing and the frequent repetition in writing fixed many words of first-grade vocabulary without further study.
1 Aids in visualizing words.
1 They can make much neater papers, more distinct. They learn to spell from typing both copy and original work.
1 Typewriters help to make children conscious of the letters and their positions in words, and so help spelling.
2 The poor writers do better in spelling on the machine I believe, chiefly because the work is plainer.
2 Typing favors accurate recognition of letters.
2 Children recognize mistakes in spelling more easily if typed.
2 Children often remark on difference in word formation as "ed" and "er."
3 There is one boy in my group who writes a most miserable hand, try as he may. He is always glad to use the machine in spelling class and I try to permit him to use it as often as I may, without seeming partial.

The typewriter facilitates perception and correction of mistakes. Mistakes are more easily seen and corrected by the pupil, by other pupils, or by the teacher. The educational values of a device which stimulates pupils to teach themselves, and to teach each other, are noted by many of the teachers.

1 The machines are a positive help here. Perusal of each child's work at the end of his typing period brings with it corrections from the teacher, which must be helpful.
1 Increases power to spell. I feel that this is one of the greatest benefits derived from the typewriters. Very little effort on the teacher's part is needed in the teaching of this subject.
1 We do not have formal spelling, but the use of the typewriters has taught children to spell their names and other words they have written.
3 They detect errors sooner. They do seem to see a misspelled word very readily. Neatness of margin and type is an inspiration to try for the same thing in handwriting.
3 Children like to test each other on each day's spelling words, one dictating words and others typing. They also like to type words during spare time, to see how many words they can spell.
4 Children can more readily see errors in spelling in typing than in work done in longhand.
5 It is easy for a child to discover his own misspelled words on a typewritten paper. Spelling words may be more quickly *checked by the children* in the subject of spelling. The children are conscious of a "shock" when they misspell a word on the typewriter.
5 The child is able to see his mistakes in spelling without anyone calling his attention to them; he can tell at a glance that the word is wrong.
6 The children often say that a misspelled word on a typewritten page "slaps them in the face." I think they are more conscious of errors and make their own corrections very often. It certainly is easier for me to grade their work.

The Typewriter and Reading

Chart 40 shows that increased experience with the classroom typewriter enabled increasing numbers of the teachers to observe favorable influences of the typewriter on reading. About half the teachers report observing good effects only three months after beginning the use of the machines; eighteen months later three-fourths of them report desirable effects and

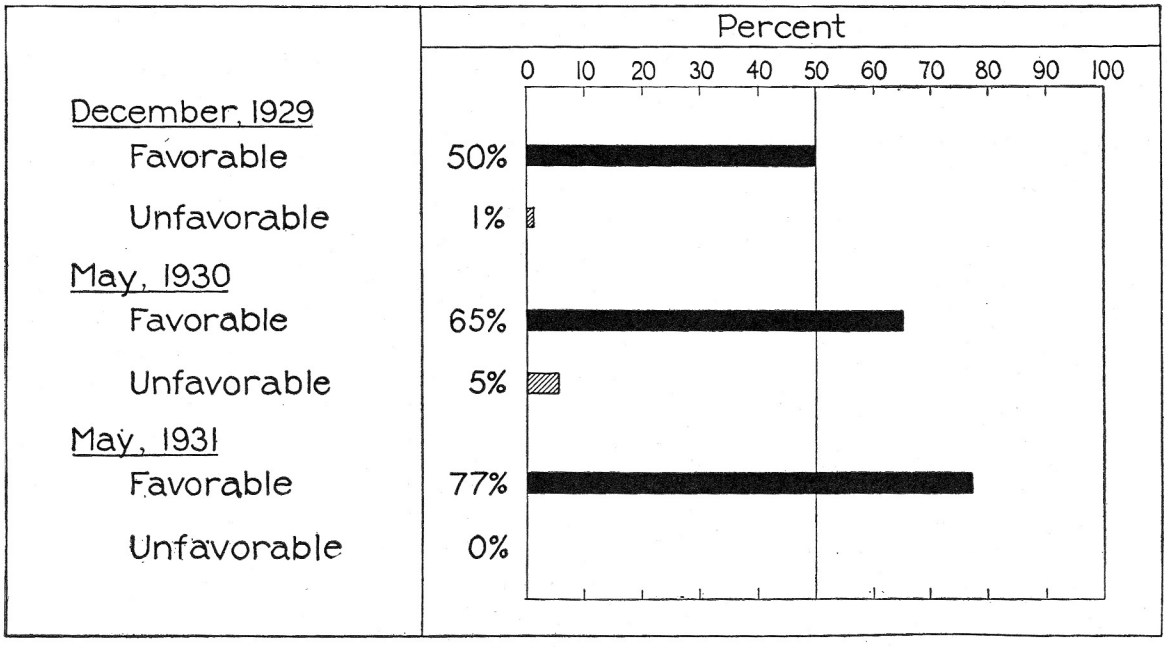


CHART 40. TEACHERS' JUDGMENTS OF THE INFLUENCE OF THE CLASSROOM TYPEWRITER ON READING

The black bars show the proportions of teachers that judged the typewriter had favorable influences; the short, cross-hatched bars show the proportions of teachers that reported unfavorable influences. The chart is based on the returns from the questionnaires answered in December 1929, May 1930, and May 1931, by the 116 teachers who had two full years of experience with the typewriter. The percentage of teachers that failed to answer is the difference between 100 per cent and the sum of the percentages of favorable and unfavorable answers as shown on the chart.

none report negative influences. The teachers mention many concrete ways in which the typewriter aids the pupils in learning and enjoying reading.

The typewriter creates "felt need" for reading. According to some of the teachers, the influence of the classroom typewriter upon reading is based upon the fundamental fact that the typewriter makes writing possible for very young children, and makes it more satisfying for children in all grades. Ordinarily, kindergarten and first-grade children know more than they are able to write with pen or pencil; with the typewriter, this situation is reversed, since even the very young children are able to write the letters of the alphabet, and some words and sentences, before they know the letters, and long before they can read the words and sentences. This novel situation of many young children making fair copies (that look just like the book!) of words and sentences which they cannot read, has challenged the thought of the Experimental teachers. A first-grade teacher makes this reservation: "If the vocabulary used for typing is known to the children, then I believe reading is strengthened; — in other words, I feel that what they type they should be able to read."

But most of the teachers in kindergarten and the early grades feel that the typing of words and sentences helps to provide a genuine and natural motivation for learning to read. The child is naturally more interested in learning the meaning of something he has copied, or plans to copy, than in reading in general. The frequency with which children go to their teachers with a word or sentence which they have copied

and ask " What does it say? " indicates the effectiveness of the motivation for reading supplied by an instrument which enables children to write clear and legible characters without overtaxing their powers of muscular coördination.

That the typewriter promotes reading readiness in kindergarten and early grades is evidenced by these excerpts from the teachers' answers:

Kdg. Before reading is attempted there has been a quickened desire to know what a piece of writing says. Never before have these children brought scraps of paper and asked "Read me this — What does this say?" A readiness for reading has come out of this.

Kdg. Children who copy from books, sometimes ask what it says.

Kdg. It has stimulated reading readiness, as children frequently ask for the meanings of specific words.

Kdg. A gain of half a year in reading was shown by the pupils of the kindergarten.

Kdg. With the use of the typewriters comes a realization that a certain grouping of letters constitutes a word — that only that grouping does. If the wrong letter is typed, then it doesn't say that word. Using the spacer sets the word off by itself. "What does it say" is heard more frequently than ever before.

Kdg. Develops the word sense earlier.

1 The typewriter leads to an earlier realization that certain groups of letters constitute words.

1 Aids in fixation of words and phrases.

1 Gives child a sentence sense; helps to eliminate confusion of many words which are more or less similar; helps increase the child's vocabulary; helps child in recognition of words and word-groups.

1 It stimulates greater interest in reading because it makes possible the wider use of experience stories, letters, and other material of vital interest to the children. Booklets, newspapers, etc., can be made which are of great interest and give much practice in reading. It serves as an incentive to better reading in that the children, for the most part, are expected to read a selection before typing it. Often children read to find poems and other material for booklets, etc. I think typing makes some children more observant of words, their likenesses and differences.

Other special advantages of the typewriter for younger pupils mentioned by the teachers are indicated by the following quotations:

1 The typewriter aids in distinguishing capital and small letter forms.

Kdg. The procedure of writing on the typewriter helps in forming the habit of reading from the left to the right side of the paper.

1 Dull children learn to read from left to right in the beginning.

1 With the typewriter young children can see punctuation more clearly.

3 The typewriter work affords splendid correlation with phonics.

3 The typewriter work seems to increase eye span and improve silent reading.

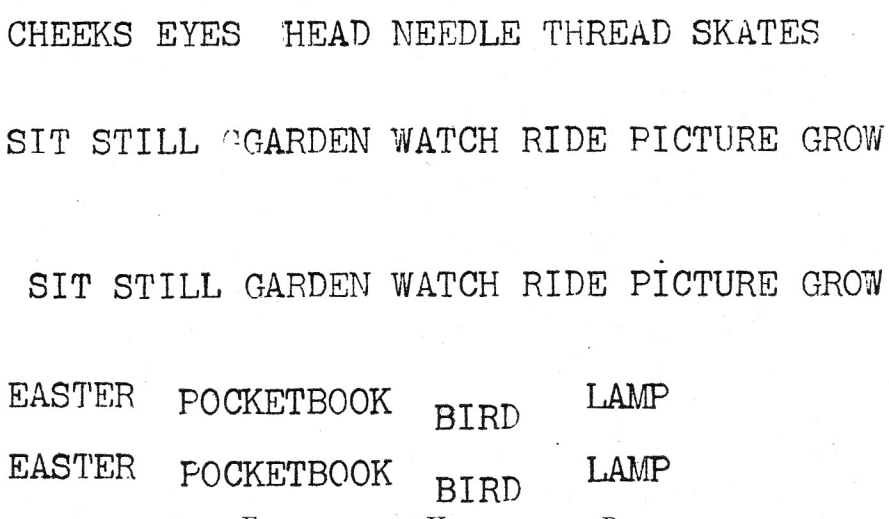
The typewriter improves silent and oral reading. Some teachers observe that the enjoyment which pupils in all grades take in reading their own writings, both copied and original, and their critical attitude in " proofing " their writings, tend to be carried over to all their reading. They often read what they have copied or composed to the class, and this tends to improve their audience reading, as well as to make their silent reading more fluent. The large amount and variety of the materials they copy tend to increase their vocabularies, to mature their " sense " for punctuation, and to establish permanent reading interests.

1 The typewriter gives greater practice in reading because a child desires to read what he has typed.

1 The typewriter provides a delightful means for voluntary practice in reading.

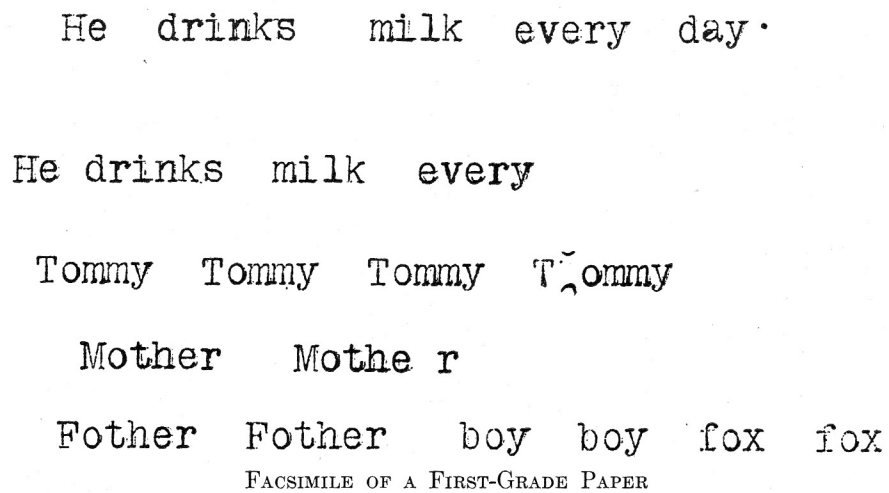
1 The children have been eager to copy words and phrases from our work in reading, and are proud to read the typed copy.

1 Phonics has come much quicker and more naturally with this class than with others. The children read all the material before typing it. In the library corner are kept their weekly newspapers which are read and reread. They read the bulletins and stories they have composed jointly.



FACSIMILE OF A KINDERGARTEN PAPER

This paper was done after the pupil had used the machine about eight months. The words were copied from the board. The pupil had learned to use the shift key and wrote the entire paper in capital letters.



FACSIMILE OF A FIRST-GRADE PAPER

The pupil had used the machine about six weeks. The sentences were used for reading material. Later the pupil copied them from the board.

2 Writing a sentence brings familiarity, and reading, then rereading the written words brings practice, which is an aid when reading from the printed page. Usually speed in typing is in proportion to reading ability and vice versa.

2 The typewriter has provided additional opportunity for informal spontaneous reading. Children are always eager to read stories, letters, poems, etc., written by their classmates.

2 Reading of their own work done on the typewriter is more fluent probably because of the greater clearness of the work.

2 It aids in oral expression in that when the child reads what he has written, he puts himself into the character that he has portrayed.

2 Such rich and varied experiences as are derived from the use of the typewriter create permanent interests in reading and develop desirable reading skills.

2 Aids in adding new words to the child's vocabulary when copying poems or portions of stories.

3 Pupils have more desire to read; children

My Reading Lesson

Which is right?

Don was a big clown.

Don was a big collie.

Don was a big collie is right.

Don took care of the garden.

Don took care of themgoat.

Don took care of the garden is tight.

Don hated the hens.

Don washed the horses.

Don hated the hens is right.

Don found the rabbits.

Don hated the roosters.

Don hated the roostersbis right.

Don lifted the baby by her dress.
Don laughed at the hen's nest.

Don lifted the baby by her dress is right.

FACSIMILE OF A SECOND-GRADE READING PAPER

This is a simple silent reading test. The pupil has read a story about Don. The teacher placed on the board several pairs of statements, based on the story. The pupil copied the statements and indicated which was correct.

enjoy and take great pride in reading stories they have typed. This has helped them a great deal in audience reading. They really want others to hear and enjoy their stories.

3 The children have written more stories I think than they would have without typewriters. All stories are read aloud by writers, thus helping their oral reading.

3 Great improvement noted in "study" reading. Questions prepared before class; stories analyzed (characters — time — place, etc.); new words listed (vocabularies increased).

The typewriter stimulates wider reading. Some teachers in all grades report that their children are often stimulated to wider reading by their desire to find material suitable for copying on the typewriter, or for use in their typewritten projects. In the upper grades, the wider reading is often of a "research" type, especially when children are searching for information for their reports, or for materials needed in their individual or group projects.

1 The children have become interested in searching through other reading books and library books for material to copy.

1 I have never had a class cover as much reading from library books as this year.

2 It encourages more intensive reading, for in leisure time the children read books and stories to rewrite or copy with the typewriter.

2 Read more in searching for material to copy.

3 Children have read more when getting information for reports.

3 Contact with reading material widened.

5 1. Read more books, etc.; 2. Make booklets, poems, letters, etc., which add to our reading material. Notices typed for cataloguing work; 3. More interest in typing book reports and records. Enjoyed cataloguing books for the entire school library.

The typewriter facilitates teachers' supervision of children's language work. Attention has already been called to the reports of some teachers that the legibility and neatness of typing increase both the amount and the effectivenes of the critical and corrective work of both teachers and students. Several teachers report that the typewriter has enabled them to give more and longer tests, particularly of the objective type, including true-false, multiple-choice, matching, and completion questions.

4 The machines enabled me to exercise closer supervision, especially in the way of check-ups and tests. I was able to give tests at more frequent intervals, and each test in less time than without the machines.

4 More reading is done and more tests actually given.

The Typewriter and Composition

Chart 41 shows that a majority of the teachers at all three dates judged that the classroom typewriter had a favorable influence on composition work in their classes. No teachers, except two in May 1930, report negative influences. The proportion of teachers giving favorable judgments increases from 58 per cent in December 1929 to 72 per cent in May 1931. These percentages are lower than the corresponding proportions for the questions on spelling and reading; but these percentages are figured on the basis of 116 teachers, including 14 kindergarten and 25 first-grade teachers. Most of the kindergarten and many of the first-grade teachers omitted answering this question, or said "We do not teach composition."

If we had restricted our count to the grades for which "composition" is an accredited subject, the proportions of Chart 41 would indicate that, in the judgment of the teachers, the classroom typewriter is more helpful in composition than in any other subject, except spelling. The excerpts from the teachers' answers reproduced below seem to justify this interpretation.

The typewriter facilitates self-expression. According to the teachers the typewriter makes writing possible for young pupils long before they can write by any other means, and more pleasant and satisfying for children in all grades.

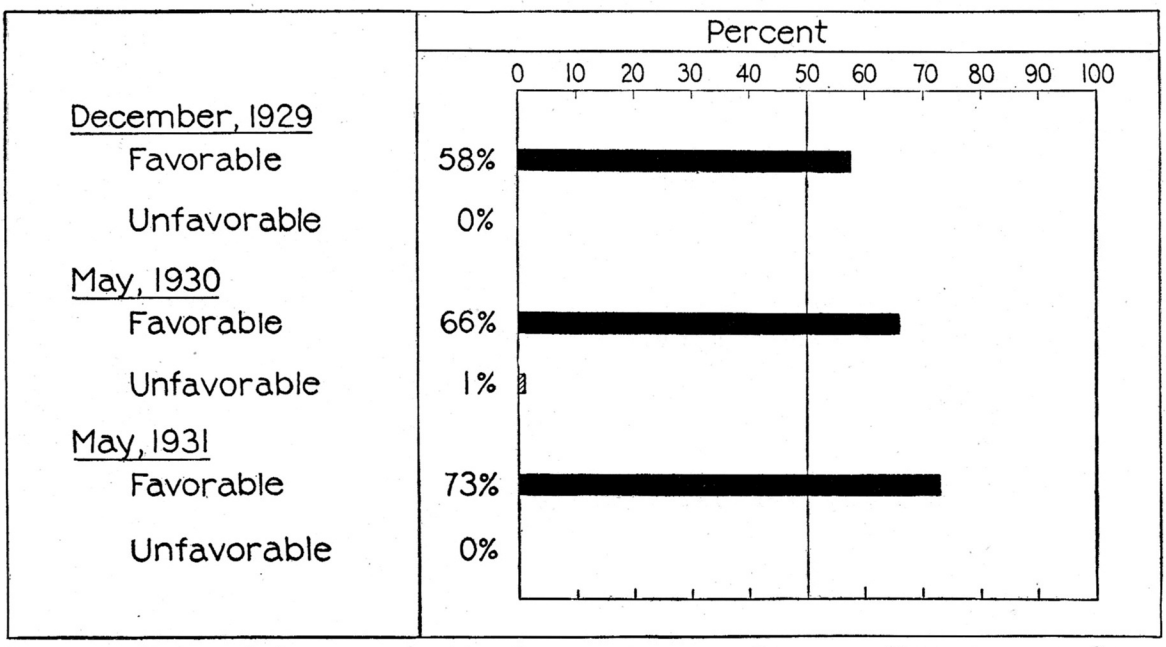


CHART 41. TEACHERS' JUDGMENTS OF THE INFLUENCE OF THE CLASSROOM TYPEWRITER ON COMPOSITION

The black bars show the proportions of teachers that judged the typewriter had favorable influences; the short, cross-hatched bar shows the proportion of teachers that reported unfavorable influences. The chart is based on the returns from the questionnaires answered in December 1929, May 1930, and May 1931, by the 116 teachers who had two full years of experience with the typewriter. The percentage of teachers that failed to answer is the difference between 100 per cent and the sum of the percentages of favorable and unfavorable answers as shown on the chart.

1 It is easier to compose an original sentence on the typewriter than in handwriting. The machine gives an opportunity for original thought work before the child can write by any other means.

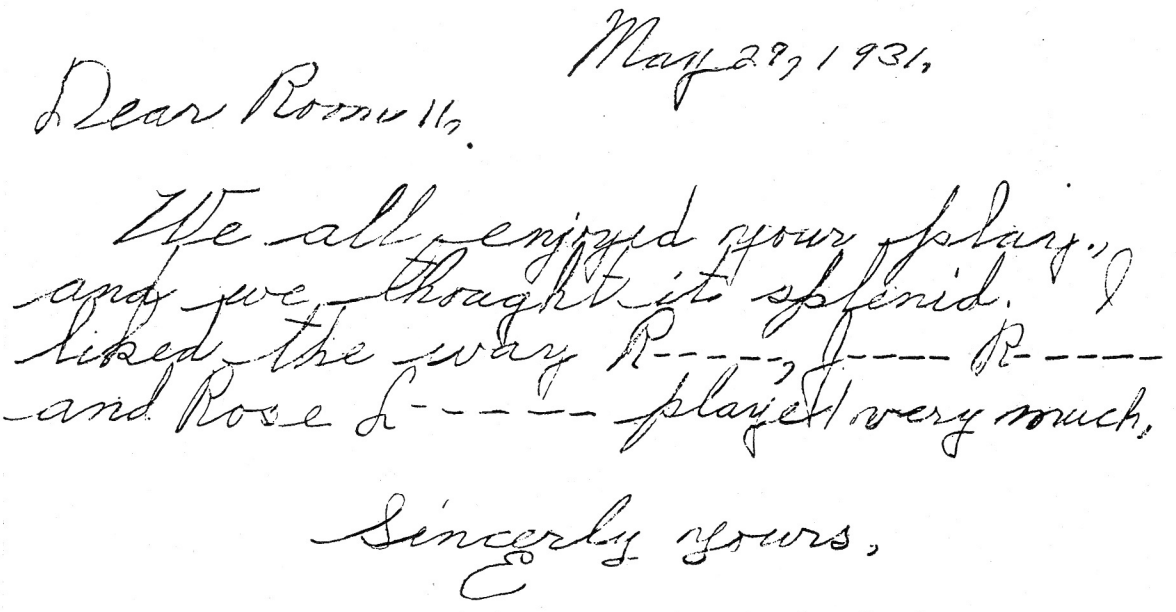
1 Before my group had learned the formation of the letters, many were trying to write stories or letters on the typewriter and getting a great deal of satisfaction from it. The children early in the year began taking over many of the responsibilities for letters which I had always taken before. The children had some idea of the formation of letters, from the use of the typewriter, before we began manuscript writing. This made it easier to master the formation.

1 Such technicalities as the following are used soon after the children become acquainted with the typewriters: 1. The capital letter at the beginning of a sentence; 2. The comma after the salutation and the ending in a letter; 3. The period or question mark at the end of a sentence. The children are able to *type* sentences and "stories" long before they would be ready to *write* them.

2 The desire to write a story to look like the stories in the books has been the greatest incentive to my children for original composition work.

2 In the past I found that very often children who composed poems were not willing or equal to the task of laboriously writing down these poems themselves. If I wished to preserve the work of these children I had the children dictate the poems to me and I wrote them down. This year *all* the original poems which have been composed have been typewritten by the children who composed them, and have been placed in our "Poem Book." Many children this term who are not among those who stand highest in the class have volunteered to write letters on several occasions — letters to sick children, "thank-you" notes, etc. The task of writing these letters on the typewriter seems so much lighter and the results so much more satisfying to the child.

2 My little children are not able to make up little stories of their own, and write them on the typewriter because many words come



May 29, 1931.

Dear Room 11,

We all enjoyed your play, and we thought it splendid. I liked the way R------, J------- R------- and Rose L------ played very much.

Sincerely yours,

May 29, 1931.

Dear Room 11,

We all enjoyed your play. I think it was very splendid. I liked the way R------, J------- R------- and R---- L------ played. All the soldiers played good. I liked the customs too. Everything was nice. I will have to close my letter now.

Sincerely yours,

E.----------

FACSIMILE OF HANDWRITTEN AND TYPED LETTERS

Both letters were written on the same date by the same fourth-grade pupil. The typed letter is twice as long as the handwritten letter.

into their stories which they are not able to spell, and they would have their hands up continually wanting the teacher to spell words for them; so they copy short stories.

2 The desire to express oneself is so strong in all children that, given an easy means of recording thought, there has resulted a surprisingly large amount of written composition. The quality of this writing has been far above that usually expected from second-grade children, and has been spontaneous. Punctuation has been learned in a natural way, also as a tool to this expression and the written form acquired by seeing the neater and more orderly page.

2 Children have many thoughts which they want to express. If given typewriters, the long tiresome process of writing these thoughts by hand, which has always been a great handicap for young children, is eliminated. Given a vocabulary suited to their needs, and a typewriter, writing stories is indeed a pleasure. Sentence structure and paragraphing have been unconsciously acquired.

The Diphtheria Clinic

Tuesday, March 3, 1931 I went to the Diphtheria Clinic at H------school with over one hundred from my school.

A motorcycle cop followed us down and stopped the cars to let us cross the streets.

Whenwe arrived there we went in and were told to sit down. The boys took their right arm out of their shirt sleeves. Then a nurse came and led us around the hall.. She took us to a lady who took our slips and gave us one tag each. We walked a little farther and a woman took our tags and on the other side of the table a woman put some iodine on our arms.

Whenwe went on the platform a fireman showed us to which doctor we should go. Therewere two doctors there.

Not one of the group which I went with cried. Some of the smaller children cried.

Another girl and I were the only ones to go from room thirteen. We went with Miss C---------.

We will have to have two more inoculations. The way they inoculate is they stick a needle under your skin and then they let some toxin-antitoxin in your blood.

If you were wise you would take this test.

FACSIMILE OF A SIXTH-GRADE ORIGINAL DESCRIPTION

This report was written after a visit to the clinic. The story is told in a straightforward way. The mechanical features of composition, such as margin and paragraphing, are approximately correct.

4 I have observed an interest in written work on the part of children poor in oral composition and those too shy to do much talking. Children can almost always talk about experiences, stories, etc., but it becomes a task to write about them. The typewriters have changed this attitude.

The typewriter increases the amount of independent writing by pupils. The Experimental teachers are emphatic in saying that the typewriter has increased the amount of writing of all kinds done by the children, but that the most notable effect has been the increase in the amount of original composition work done by pupils. Many of the teachers comment on the new attitude of their children toward composition, noting particularly the independent way in which they conceive and carry out their written projects. According to these teachers, the manifestations of intellectual initiative and self-reliance are more prominent than they were before the machines became available.

1 The typewriter is an aid in developing initiative and self-reliance in creating and carrying out plans.

1 Typewriters have made it possible for children to write much more difficult material than their limited capacity in handwriting would ordinarily allow.

1 Makes possible a much larger quantity of written composition, thus raising the quality.

4A NEWS

F----- SCHOOL P---------- March 1930

Safety Patrol

Did you ever notice the boys and girls who stand near the stairways and in the halls in the mornings and at noon? They are called Safety Patrols. They help us to keep our lines straight and remind us to. walk single file. Let us each do our part in helping them in their work.

John Rayl.

Clean Up

We are thinking about keeping our school clean."Clean Up Week" will soon be here. And we want to be ready for it. Most children that are clean are healthful. Let us try to be clean children, in a clean school, and in a clean city.

Clarence Haynes

Our Favorite Policeman

Mr. Marty the policeman on the F----- School beat,is back on duty The boys and girls missed him very much and are happy to see him on duty agian. He is very glad to be back and thanks the boys and girls for the flowers and fruit they sent him.

Ruth Brandau

Auditorium News.

The 4A class is going to have a play play in the auditorium. Miss Zinn is directing it but we are all hilping to make it good. The name of the play is "King Alfred and the Cakes. One girl and the rest boys take partin the play. We plan to give it in the auditorium soon.

Shirley Puretz

Spelling Contest.

The 4A's andtthe 4B's are having a spelling contest. The 4A's where winning at the beginning but now the 4B's are winning.

Evry Friday we have are spelling and Miss Wall the teacher is hoping that both classes will get a good mark.

Calatea Paschale

Typewriters.

The boys and girls of Frick School are using typewriters for their class work. It is the only School in Pittsburgh that uses them. There are several different kinds, Cronas,Royal,Remington,Smiths,and Underwood. The children apperciate. them and hope to have themnextt year.

Jane Dent

Stunts.

The 4A boys are doing stunts. Tney are doing several dieffrent kinds such as the hand stand against the wall, the chair crawl, andtthe forward and backward roll. Their specialty is the combination dip.Come in some Tuesday and watch us.

Rena Cohen.

Base-Ball

The 4A boys have a team. We have already started to practice. We are going to play the 4B's, 5B's and 5A's. We boys think that base-ball is the best game in the world next to football We will soon play our next game.

Albert D'Andrea.

Sports

The 4A girls are having two dances the first one is a Garden dance the other a Clog.

Miss Gerlinger promised that we may give them in the Auditorium some day soon.

Shirley Stine

STORIES.

Once there was a lit tle girl. Her name was Joan. She lived in a little cottage at the edge of a hill. Easter was only a week away and she was trying to be a good girl so that she would get a basket full of eggs and chocolate bunnies and little peeps. She did many little thingsto help her mother. On Easter morning she got all the colored eggs and good chocolate bunnies in her Easter basket that she could eat.

Margoret Flynn

Believe it or Not.

Claire Newlon has read 25 books this semester.
Shirley Puretz can turn a cartwheel into the water.
Hubbard Kirpatrick can swim like a dog.
James Blyth threw the ball 37 feet.
John Rayl threw the ball 41 feet.

Marion Hersch.

POEMS.

There was a little hen named Fanny,
She swallowed a bright red manny,
She fell on her back,
And gave a quack,
And was put into bed by her granny.

Jane Dent.

A wise old owl so I've been told,
Hooted and hooted out in the cold.

Rena Cohen.

If I were a flower,
I 'd live in a bower,
I 'd bloom each day,
So bright and gay.

Jane Dent.

An Easter bunny is beautiful,
He has many little dears,
I hope next Easter Sunday,
He will stop right here.

Betty Wilson.

Advereisements.

If you want some clean children
Come to the F----- School.

If you want a good reader take Claire Newlon.

If you want a good poet take Ellen McCulloch.

Read some interesting books in the F----- School Library.

If you want a good tap dancer take Rena Cohen.

If you want to see good workers
Come to F----- School.

FACSIMILE OF TWO PAGES OF A FOURTH-GRADE CLASS NEWSPAPER

Each item was composed and typed by a different pupil. Note the wide range, and the "live news" character, of the topics.

Delivering Papers

Around and around the block I go,
Delivering papers from door to door
Rain or shine I have to go,
Around and around the block I go.

Knock, knock at the door,
People answering to and fro
Wanting papers all around:
Around and around the block I go.

A long the road I meet some friends,
Asking where have you been again?
Answering questions to and fro,
Around and around the block I go

E----- W-------

FACSIMILE OF AN ORIGINAL POEM

Composed and typed by a sixth-grade pupil.

1 The child has access to a greater variety of interesting and stimulating material and an opportunity to work these ideas out in a satisfying manner.
2 It brings out a great deal of originality — particularly with children who do not enjoy "making up" stories. These children now anticipate original composition work with enthusiasm.
2 Children in this grade have been interested in writing "original stories" on the typewriter more than in any other type of work that they have done. Has helped in punctuation also.
2 More written work was done. They learned to express their own ideas and did this during activity period, independently. They could see the arrangement of letters better by typewriting them.
4 The compositions are considerably longer and the variety is greater.

The typewriter reduces distraction of writing. The reduction of the distracting effect of writing as a mechanical process effected by the typewriter is a source of great satisfaction to some teachers and pupils. In typewriting, the teachers say, the child's mind is more on *what* he is writing than on

the task of transmitting it to the paper in legible form. There is less interference with thinking when writing with the machine than with pen, pencil, or crayon, particularly in the lower grades. This judgment of the Experimental teachers should reassure those who may fear the " mechanizing " influence of the typewriter, for in their opinion the machine tends to reduce and simplify the mechanics of writing, and tends to free the mind of the writer for more effective thinking and composing.

1 It is astonishing the results I have been able to accomplish in original stories through the use of the typewriter. *The child seems so free to express his thoughts and it is not a task at all.* Longer compositions are obtained. Sentence structure is realized and employed.
1 When typewriting, the children's thoughts are more on composing than on the formation of letters.
2 Much more composition work is possible because the typewriter gives the child an easier means of expression. Very often in handwriting the mechanical effort is so great that the child forgets to put himself into the story he is writing. The most outstanding result of the investigation, I think, can be seen in the written composition work.
3 The children are freer in expression. They do not seem to tire in writing a lot on the typewriter as they do in longhand.
3 More originality is shown in typewritten than in handwritten work.

The typewriter helps teach language and writing form. According to some teachers, the presence on the keyboard of the comma, the period, the question mark, quotation marks, the hyphen, and the fact that these are on movable keys, and that capital letters can be made with the aid of a shift key, leads many children to become interested in these linguistic appurtenances, and to learn much about their uses almost unconsciously and without effort. The children also develop habits of good form with the aid of the machines.

1 Children have learned to recognize punctuation, from capital letters to hyphen, being curious enough at times to ask why they are used. I feel every child remembers to begin a sentence with a capital letter from the constant use of the shift key on the typewriter.
1 The children have learned the use of the capital letter and period. They are conscious of other punctuation marks which will aid them later.
1 Punctuation and capitalization have been more easily taught and understood.
2 Through the experimentation with the typewriter the children have *of their own accord* become interested in the many uses of capital letters and punctuation marks. In my past experience with second-grade children I have found that punctuation and capitalization have held no particular interest for young children but had to be taught simply as drill subjects.
2 It is an aid in learning sentence formation, as the use of capital letters, periods, and commas. They learn form of writing letters because they enjoy writing them on the machine.
2 The typewriter has been a great help in punctuation, capitals, contractions, *letter form*, writing addresses, training in sentence structure, abbreviations, and in a few cases, the use of the apostrophe. Copying poems for special days.
2 There has been a marked improvement in capitalization, punctuation, and indenting in original work. There has also been a much better arrangement of work.
3 There is more interest in story writing; the child loves to type his story. Arrangement improved. Finds mistakes more readily.

Detailed influences of the typewriter on composition. The importance of composition, and the large number of more or less independent elements that make up this complex function, led us to seek the judgments of the teachers on the detailed influences of the classroom typewriter on composition. For this purpose the tabular question shown in Table 7 was included in the May 1931 questionnaire. The percentages of the 116 two-year teachers checking each answer are shown.

For convenience of reading, the percentages checking " Positive Influence " and " Negative Influence " are shown graphically in Chart 42. The light solid lines show the

E---------- March 9, 1931.

NEWS OF THE WEEK.

HOW TO BE SAFE

When you come to the the street you shound, always stop, look and liston. You should not go right across the street or you will get hurt. When you get off a trolley car do not go across the street,

Look and see if there are any cars in sight. If there is a car in sight do not cross the street. If there isn't any car in sight cross the street.

If you are in yourfather's car and you are going fast ask your father to go slow or you will have a wreck and you will get hurt.

What we should eat.

We should eat , breakfast, dinner, and supper. We should not eat candy between our meals.

We should eat vegetables.

The vegetables we should eat are , spinach, tomotoes, celery and poataoes. We should not eat candy. We could eat fruit too.

ATTENDANCE.

We have had some children absent this morning. Their names are Marice, Grace Martin and Wheeler Sisk. That is all we have had this morning.

E---------- & March 9, 1931.

NEWS OF THE WEEK.

OUR MINERAL SCHART

We have minerals in our desks and we have made mineral charts for them. If we have the minerals we get a star for the minerals that we have. Some boys made mineralscharts on the typewriter.

Their names are Roland Charest, Robert Budriand that is all.

I have all of mine expect three of them. The names of the minerals that I haven't got are, jasper, marble and slate.

NAMES OF BOOKS THAT I LIKE

The sunbonnet babies in holland.

The sunbonnet babies in Italy

Hans and Hilda of Holland.

Safety First stories.

Minerals

Quartz is a mineral.

Feldspar is a mineral.

Mica is a mineral.

Flint is a mineral.

J asper is a mineral.

Quartz
Kinds.

1. glassy
2. milky
3. rosy
4. smoky
5. iron.
6. amethyst.

FACSIMILE (SLIGHTLY REDUCED) OF TWO PAGES FROM A FOUR-PAGE NEWSPAPER

This work was done by a fourth-grade pupil. Each individual in the class prepared his own news summary for the week. The topics discussed included the weather, diet, safety rules, and various minerals which had been studied.

TABLE 7

THE JUDGMENTS OF TEACHERS REGARDING THE DETAILED INFLUENCES OF THE CLASSROOM TYPEWRITER ON COMPOSITION

The table shows the percentages of the 116 two-year teachers who checked indicated answers for each element of composition.

	POSITIVE INFLUENCE	NEGATIVE INFLUENCE	NO INFLUENCE
	%	%	%
Completeness of sentences	63	1	36
Length of sentences	47	4	49
Variety in sentence structure	21	2	77
Size of vocabulary	61	3	26
Appropriateness of vocabulary used	40	4	56
Uniformity of indentation	72	5	23
Evenness of margin	83	3	14
Absence of illegible and crossed-out words	60	9	31
Correct use of the capital	78	6	16
Correct use of period	78	2	20
Correct use of comma	47	9	44
Correct use of question mark	62	3	35
Correct use of quotation marks	48	5	47
Agreement of subject and verb	8	3	89
Correct choice of prepositions	7	3	90
Accurate use of conjunctions	7	3	90
Accurate use of adjectives and adverbs	7	3	90
Use of figures of speech	5	0	95

percentages of kindergarten and first-grade teachers, and of fourth-, fifth-, and sixth-grade teachers that indicated "Positive Influence," separately.

Quite expectedly, evenness of margin, being automatically cared for by the typewriter, is checked favorably by a larger number of teachers than any other element of written composition. The items next in order are correct use of the capital and of the period, and uniformity of indentation. Sixty per cent of the teachers notice a favorable influence of the typewriter on completeness of sentences, correct use of question mark, and size of vocabulary. Improvement in some of the elements listed in Chart 42 is more easily observed than in others. It would be difficult to observe directly even a large improvement in the elements listed near the bottom of the chart, and only a few teachers indicate that they have observed improvement in them. That improvement did take place in these "language usage" elements of composition is, however, indicated by the test results presented in Chapters II and III. The fact that some of the items were checked at all is undoubtedly due to the halo effect against which the reader must be on guard throughout this and succeeding chapters.

The smaller proportion of lower grade teachers checking positive influences is due to the fact already mentioned that "composition" is not an accredited part of the kindergarten or first-grade curriculum, and many of the teachers failed to answer the question or checked no influence. The only item checked favorably by a larger proportion of lower than of upper grade teachers is size of vocabulary.

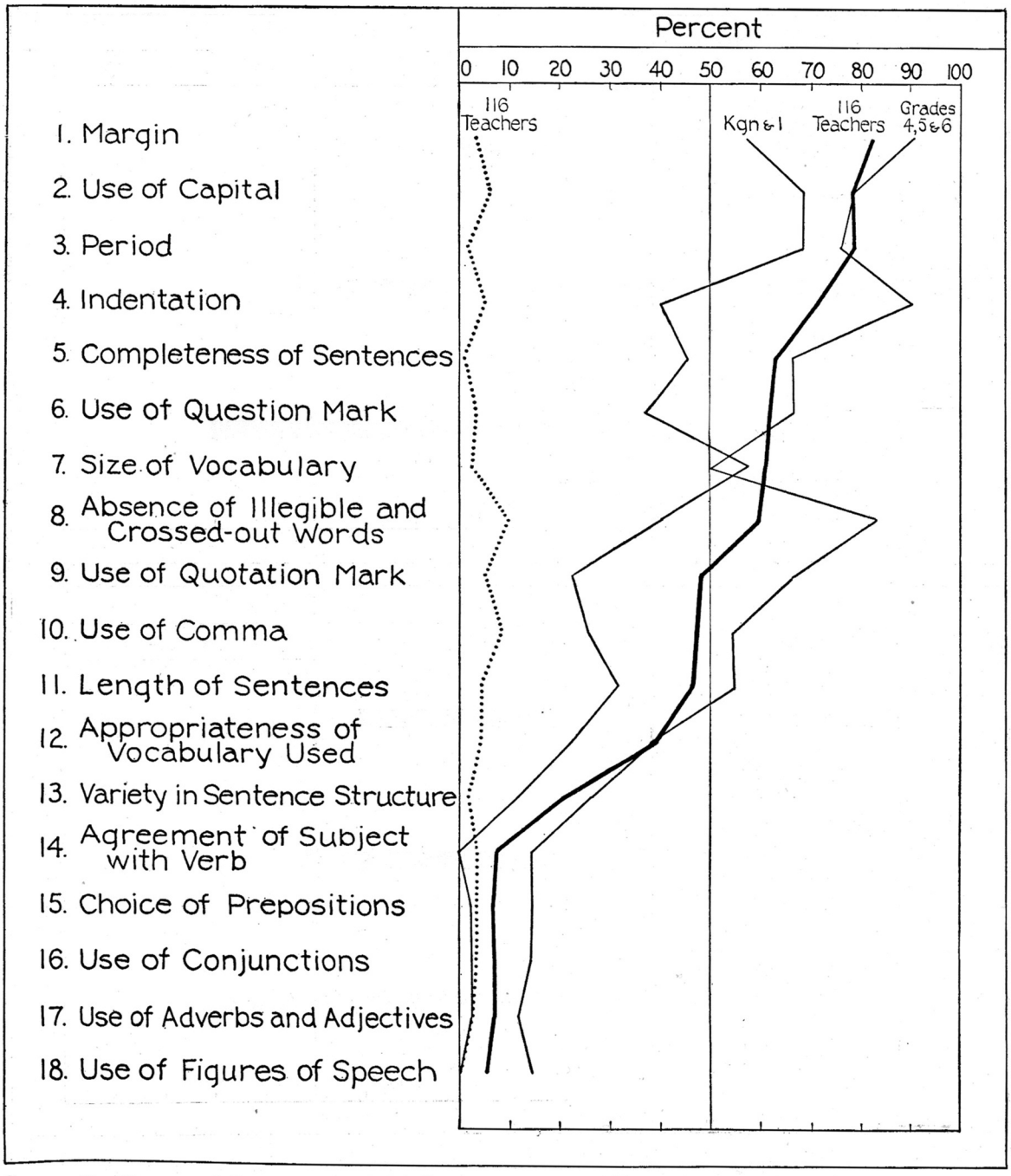


CHART 42. TEACHERS' JUDGMENTS OF THE INFLUENCE OF THE TYPEWRITER ON DETAILED ELEMENTS OF COMPOSITION

The points connected by solid lines show percentages of indicated groups of teachers reporting positive influence on indicated elements; the dotted line shows percentages reporting negative influence. The teachers' judgments are based on two full years of experience with the classroom typewriter.

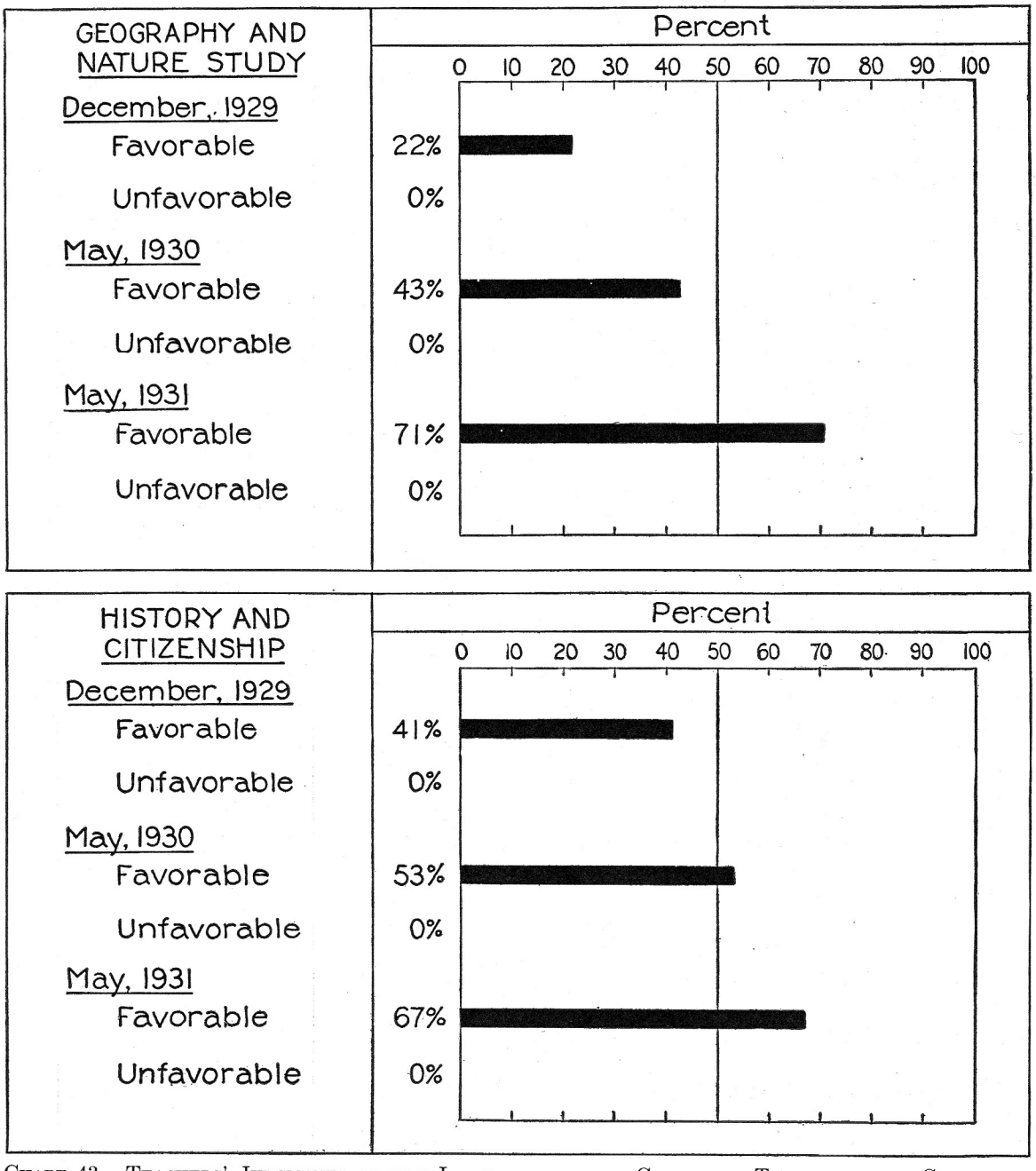


CHART 43. TEACHERS' JUDGMENTS OF THE INFLUENCE OF THE CLASSROOM TYPEWRITER ON GEOGRAPHY AND NATURE STUDY, AND ON HISTORY AND CITIZENSHIP

The long black bars show the proportions of teachers that judged the typewriter had favorable influences; there were no teachers who reported unfavorable influences. The chart is based on the returns from the questionnaires answered in December 1929, May 1930, and May 1931, by the 116 teachers who had two full years of experience with the typewriter. The percentage of teachers that failed to answer is the difference between 100 per cent and the percentage of favorable answers as shown on the chart.

The Typewriter and Geography and Nature Study, and History and Citizenship

Chart 43 shows that the numbers of teachers who reported favorable influences of the typewriter on these studies increased markedly as their experience with the classroom typewriter increased. In December 1929, three months after they began the use of the classroom typewriter, only 22 per cent of the teachers reported observable effects on geography and nature study; in the following May over 40 per cent reported desirable effects, and in May 1931, 70 per cent of the teachers reported favorable influences. The numbers of teachers who reported favorable influences on history and citizenship in December 1929, May 1930, and May 1931 increased substantially but not quite as much as in the case of geography and nature study. No teacher reported negative effects on any of the three questionnaires.

In these subjects the advantages of the typewriter that are mentioned by the teachers are those that we would expect in view of the teachers' judgments on the influence of the typewriter on the interests and attitudes of the pupils, on the social life in the classroom, and on their work in reading and composition. A considerable part of the increased writing of the children was in connection with these subjects. The illustrated booklets, posters, charts, maps, exhibits, etc. were more intelligible and attractive to the children because the titles, legends, and labels were longer, neater, and more legible.

Variety of written projects. Types of writing and of projects mentioned by the teachers as evidence of the influence of the classroom typewriter on these subjects included the following:

Stories of nature study walks
Bird and animal booklets
Labels for nature specimens
Records of trips in the community
Weather reports
Lists of wild flowers
Illustrated booklets about growth of seeds
Booklets about development of frog
Maps, charts and graphs improved by use of typewriter
Booklets on bird life
Records of dates when trees blossom, bud, and leaf
Stories for booklet "Children of Many Lands"
Reports of experiments
Stories about silk culture
Research work in social studies
Longer reports and notebooks in geography than without the typewriters
Lists of cities, locations, and products
Book on "History of Transportation in the U. S."
Descriptions typed on cellophane lantern slides
Stories on simple historical subjects
Stories about Robinson Crusoe
Indian project — stories and illustrations
"Trip Book"
History stories written after studies of Cabot, Columbus, Champlain and other "Explorers"
Stories about Primitive Life, Cave Dwellers, Tree Dwellers, Ancient Peoples
Outlines of chapters on history
Stories of explorers
Extensive map work
Plays about people studied, explorers, pioneers
History notebooks
Multiple-choice tests in history

Civic habits formed. A large number of teachers mentioned the opportunities afforded by the classroom typewriters for training in good citizenship and for the formation of civic habits. This is true of teachers of all grades, but especially of those in the lower grades where the instruction emphasizes habits of conduct rather than the academic aspects of citizenship training that are more prominent in the higher grades. Many instances of children's growth in coöperativeness, in intellectual independence, and in responsibility as evidenced by their care of the machines and other school equipment, are mentioned by many of the teachers; but since these expressions of the teachers are practically a duplication of the statements already quoted

FACSIMILE OF A MAP PREPARED IN THE SIXTH GRADE

The pupil has typed the names of countries. The total result is a clean-cut, readable piece of work.

.Social Studies.

peninsula. May , 5, 1931.

A piece of land that juts out into the water is called a peninsula.

pilgrim.

A person who travels from one country to another is a pilgri

surrender.

Surrender means when a person gives in.

Roger Williams.

Roger Williams made a settlement in Rhode Island.

New York.

The Dutch people settled New York.

Dutch.

Peter Minuit and Peter Stuyvesant were Dutch.

Henry Hudson.

Henry Hudson discovered the Hudson river.

Pacific.

The Pacific is a ocean.

New Amsterdam

At first the Dutch named New York New Amsterdam becausen there was a country in Holland that was named Amsterdam.

Cartier.

Cartier discovered the St. Lawerence.

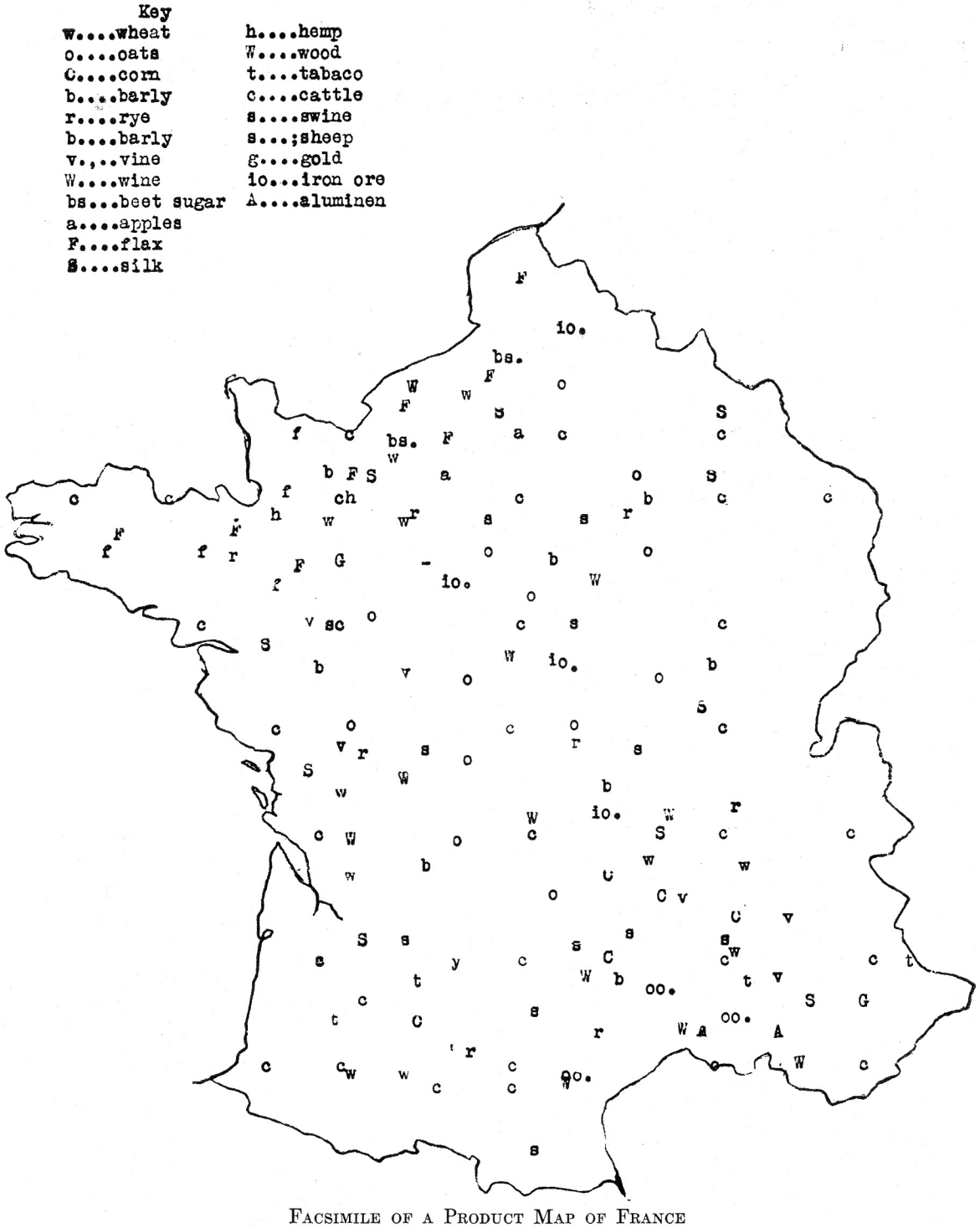
Champlain.

Champlain discovered Quebec.

Africa.

FACSIMILE OF SOCIAL STUDIES EXERCISE

This paper was prepared by a fourth-grade pupil. He typed the word or name in red, and added a brief definition in black, his machine being equipped with a two-color ribbon.



FACSIMILE OF A PRODUCT MAP OF FRANCE

This is the work of a sixth-grade pupil, who had used the machine for two months. Each product is represented by a letter on the map. A few unconventional spellings are found in the key.

Sixth Grade

March 25,1931

Matching Game
History

1. The Indians were	9. the natives of America.
2. The Indies were	7. the countries far East.
3. Spain was	3. the country which helped Columbus.
4. The Canary Islands were	5. where Columbus ships stopped for repairs.
5. 1492 was	1. the year which Columbus discovered America.
6. Discovery means	2. to find something tne world has not known before.
7. A discover is	8. the finding of things new to the world.
8. To discover means	4. a person who finds something that the world has not know before.
9. A mutiny is when	6. followers refuse to obey thier leaders.

FACSIMILE OF A SIXTH-GRADE HISTORY TEST

The pupil copied the left-hand series of statements. The right-hand series had been written on the board. The pupil rearranged the items to match those in left-hand series.

regarding the influences of the typewriter on the social atmosphere of the classroom, none of them will be quoted here.

The Typewriter and Arithmetic

Chart 44 shows that the Experimental teachers became increasingly conscious of the contribution made by the typewriters to arithmetic. In December 1929 less than 30 per cent of the teachers reported favorable effects; six months later the proportion had grown to 38 per cent, and a year later to more than 50 per cent. No teachers reported negative effects on the first two questionnaires and only two out of 116 teachers gave answers in May 1931 which were classified as negative. One of these two teachers says that the typewriters lessen the speed with which the children do their arithmetic work, and the other teacher complains that the children waste time, especially in doing fractions on the typewriter. Whether the longer time spent by these children on arithmetic at the typewriter is desirable or not is an interesting question which cannot be answered with the data at hand; but some of the teachers comment on the amazing fact that some of their pupils seem to enjoy their arithmetic more when done on the typewriter in spite of the disadvantage that some of the work which they voluntarily do on the machines takes more time than it would by hand. The judgments of the teachers summarized in Chart 44 and illustrated below confirm the indications of the test results in Chapters II and III that the typewriters have a positive influence on achievement in arithmetic. It seems clear that further detailed research is necessary in order

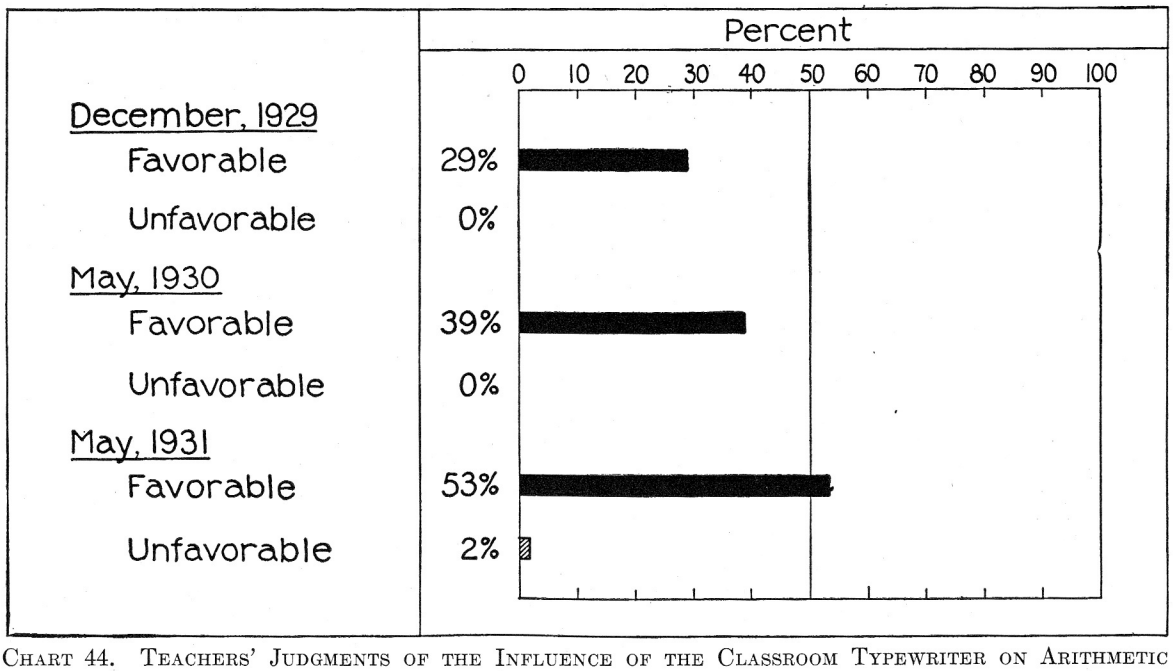


Chart 44. Teachers' Judgments of the Influence of the Classroom Typewriter on Arithmetic

The long black bars show the proportions of teachers that judged the typewriter had favorable influences; the short, cross-hatched bar shows the proportion of teachers that reported unfavorable influences. The chart is based on the returns from the questionnaires answered in December 1929, May 1930, and May 1931, by the 116 teachers who had two full years of experience with the typewriter. The percentage of teachers that failed to answer is the difference between 100 per cent and the sum of the percentages of favorable and unfavorable answers as shown on the chart.

FACSIMILE OF PAGE TYPED BY A FIRST-GRADE CHILD AFTER THREE MONTHS OF EXPERIENCE WITH THE CLASSROOM TYPEWRITER

The pupil evidently started out to tell about Fred making a chair, but was attracted by the numerals on the keyboard and "played" with them for a while, writing numbers up to 29 once, and up to 11 once. Books and a doll, fractions and special characters on the keyboard, furnished a brief interlude, after which he resumed writing the numbers up to 100. This paper illustrates the "free and self-initiated" character of much of the work done by the younger children at the machines, and shows how the typewriter of itself led children to do number work of their own accord.

to ascertain the nature and extent of this influence.

The typewriter helps to establish clear images of the numbers. Several teachers call attention to the fact that the typewriters afford an informal and effortless, but almost inescapable, way of securing accurate and clear-cut images of the numbers.

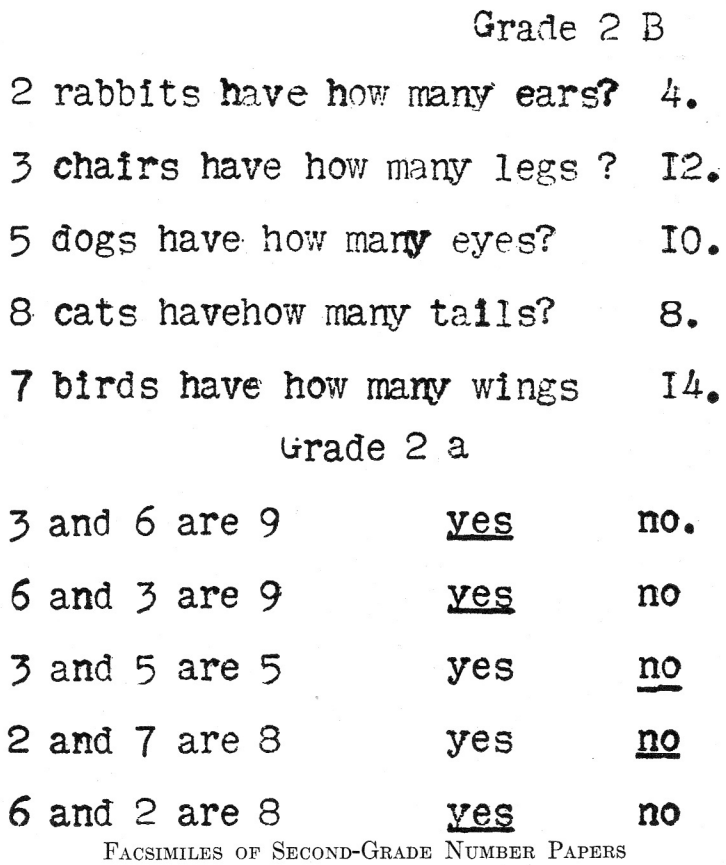
Kdg. The picture of each number is seen correctly; therefore each is copied without turning it around as little children so often do: ⌜ for 7, Ɛ for 3, etc.

Kdg. Children learn to know numbers by sight.

Kdg. Affords an opportunity for the recognition of numbers.

1 Quite a help in learning to recognize number characters, and in writing of same on the typewriter.

The typewriter helps to associate meaning with number symbols. According to many of the Experimental teachers the typewriters lead children almost unconsciously to an earlier recognition of the



FACSIMILES OF SECOND-GRADE NUMBER PAPERS

The teacher placed the questions in the first paper on the board. The pupil copied them and added the correct answer for each question. The complete statements in the second paper were placed on the board. The pupil copied them and underlined the correct answer for each line. Note the correlation of written language and number work.

sequence, meaning, and use, as well as of the correct forms, of numbers.

Kdg. Children are learning to recognize the numbers to 25 and sometimes 50, three and four months before they generally do, through the typewriters. This early recognition of numbers means that most of the kindergartners are able to tell time and read the calendar by the end of their kindergarten year.

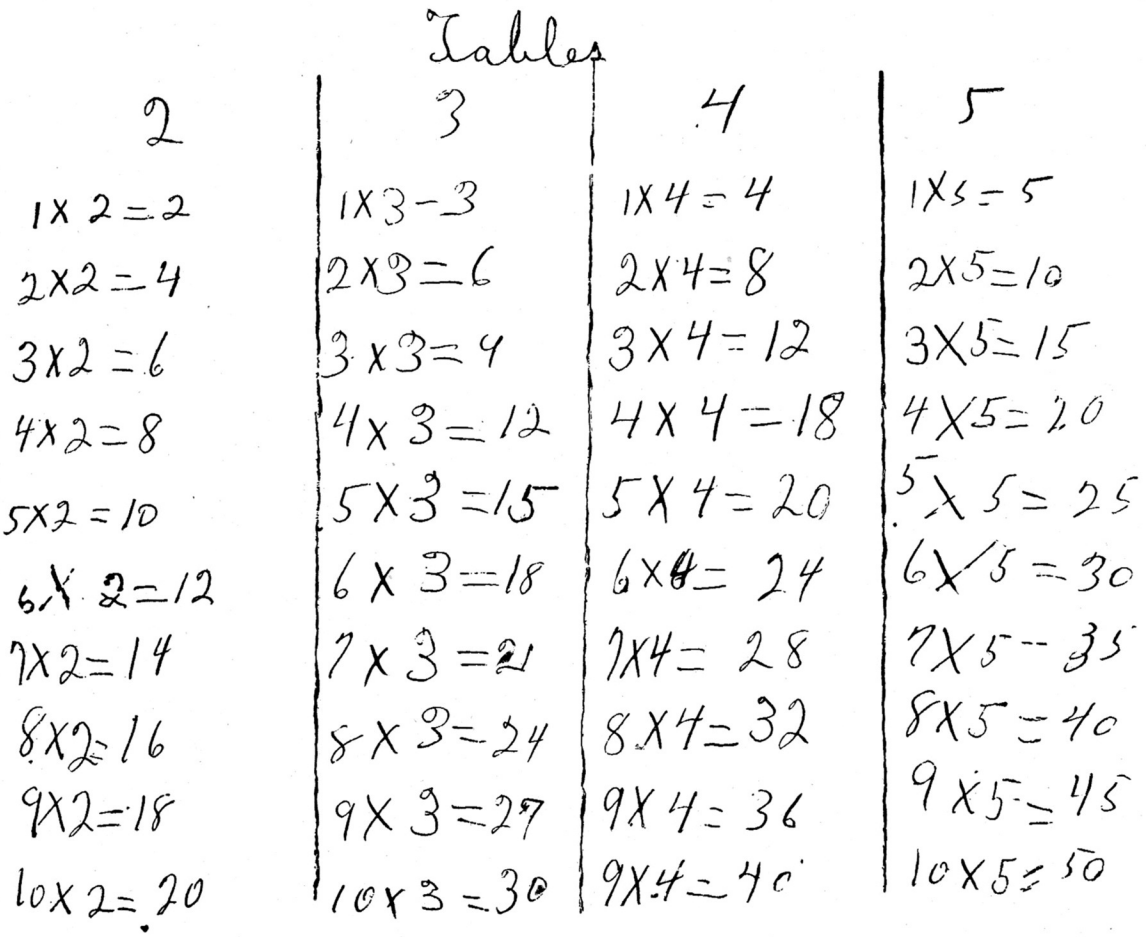
Kdg. There are many real situations in kindergarten calling for the use of numerals. The typewriter gives a perfect numeral. With their limited muscular control it is difficult for little children to make figures satisfactorily, numbers are often formed incorrectly, leading to habits which have to be changed in the next grade or two. Typing the numbers of the rooms, typing the numerals in series to ten or more, typing date as 1930–1931, making price tags, etc., tend to familiarize the pupils with the numerals and they get *satisfaction in the results* as well as some number concepts in using the machines for such purposes.

Kdg. The very finest pedagogical means of exercising a budding number sense.

Kdg. Use of the typewriter has acquainted the children with the appearance of figures and they have learned to recognize their names. It also encourages the child to count. They enjoy counting the number of words they have typed.

Kdg. The child learns to associate the number with the symbol. Learns to write numbers consecutively more readily than by hand.

1 The typewriter has taught them counting to 100, and the building up of 100 by tens, fives, two, etc., by the orderly



Tables

2	3	4	5
1 x 2 = 2	1 x 3 = 3	1 x 4 = 4	1 x 5 = 5
2 x 2 = 4	2 x 3 = 6	2 x 4 = 8	2 x 5 = 10
3 x 2 = 6	3 x 3 = 4	3 x 4 = 12	3 x 5 = 15
4 x 2 = 8	4 x 3 = 12	4 x 4 = 18	4 x 5 = 20
5 x 2 = 10	5 x 3 = 15	5 x 4 = 20	5 x 5 = 25
6 x 2 = 12	6 x 3 = 18	6 x 4 = 24	6 x 5 = 30
7 x 2 = 14	7 x 3 = 21	7 x 4 = 28	7 x 5 = 35
8 x 2 = 16	8 x 3 = 24	8 x 4 = 32	8 x 5 = 40
9 x 2 = 18	9 x 3 = 27	9 x 4 = 36	9 x 5 = 45
10 x 2 = 20	10 x 3 = 30	9 x 4 = 40	10 x 5 = 50

Tables . Oct. 29, 1930.

2	3	4	5	6	7	8	9
4	6	8	10	12	14	16	18
6	9	12	15	18	21	24	27
8	12	16	20	24	28	32	36
10	15	20	25	30	35	40	45
12	18	24	30	36	42	48	54
14	21	28	35	42	49	56	63
16	24	32	40	48	56	64	72
18	27	36	45	54	63	72	81
20	30	40	50	60	70	80	90

FACSIMILE OF HANDWRITTEN AND TYPED ARITHMETIC PAPERS

Both papers were done by the same fourth-grade child; the typed work in October 1930, after one month's experience with the classroom typewriter, and the hand work in January 1931.

arrangement of the numbers on their papers, following the arrangement of the numerals on the keyboard.

1 The typewriter helps the children recognize the numbers and learn their proper sequence.

1 The children like to do combinations on typewriter; they would write numbers all day if allowed.

1 At the beginning of the year the children spent a great deal of time making the numbers from 1 to 10. Some of them learned to recognize the numbers entirely through the typewriter.

1 Some children have grown interested in the numbers on the machines, the names and the formation of the numbers. One child wanted to do sums on the machine, but found the manipulation of the machine too difficult.

1 The children type records of the cost, size, quantity of materials bought, or to be ordered. Example: shopping lists to take to the store.

1 basket of grapes
5 lbs. of sugar
12 jelly glasses

The children have learned to read and typewrite dollars, cents, doz., etc. They do numbering on their spelling lists. They write the dates for the class newspaper.

1 The typewriter increases the understanding and feeling of numbers by the use of spacing, repetition, counting the number of sentences completed and by an occasional use of the figures; also gives practice in the recognition and meaning of the names of the numbers.

1 I do not teach this subject in my grade, but I can say the children love to type the numbers. *A great many can't write the numbers, and being able to make them on the typewriter means a great deal to them.* More experience is given in counting and writing of numbers.

1 The children love to write numbers on the typewriters, probably because the numbers come consecutively. They do far more writing of numbers than they would do without the typewriters. They write them from one up to fifty, or sometimes to one hundred. Some of the children do not have to have any copy for this work, and all soon learn the numbers.

2 I notice very little effect, with the exception of the enjoyment which many children get from writing numbers and counting by 1's, 5's, and 10's. The typewriter has set a correct pattern for writing numbers, thus eliminating much of the incorrect writing which formerly occurred in Second Grade.

2 Number writing on the typewriter is a distinct joy to the Second Grader. One boy wrote numbers from 1 to 1000 taking several days to complete the task. Others being inspired wrote several hundred. It impressed the number places needed for each figure on their growing minds. A very little work has been done in simple examples.

2 Our number work in grade II is informal. The typewriter has helped in writing the date, in writing dollars and cents, in writing in columns, and in numbering pages. Class has made lists of things — tulips, 4 in. high, crocuses, 2 in. high.

2 In connection with our Grocery Store, the typewriter helped in writing items of store orders and in writing dollars and cents.

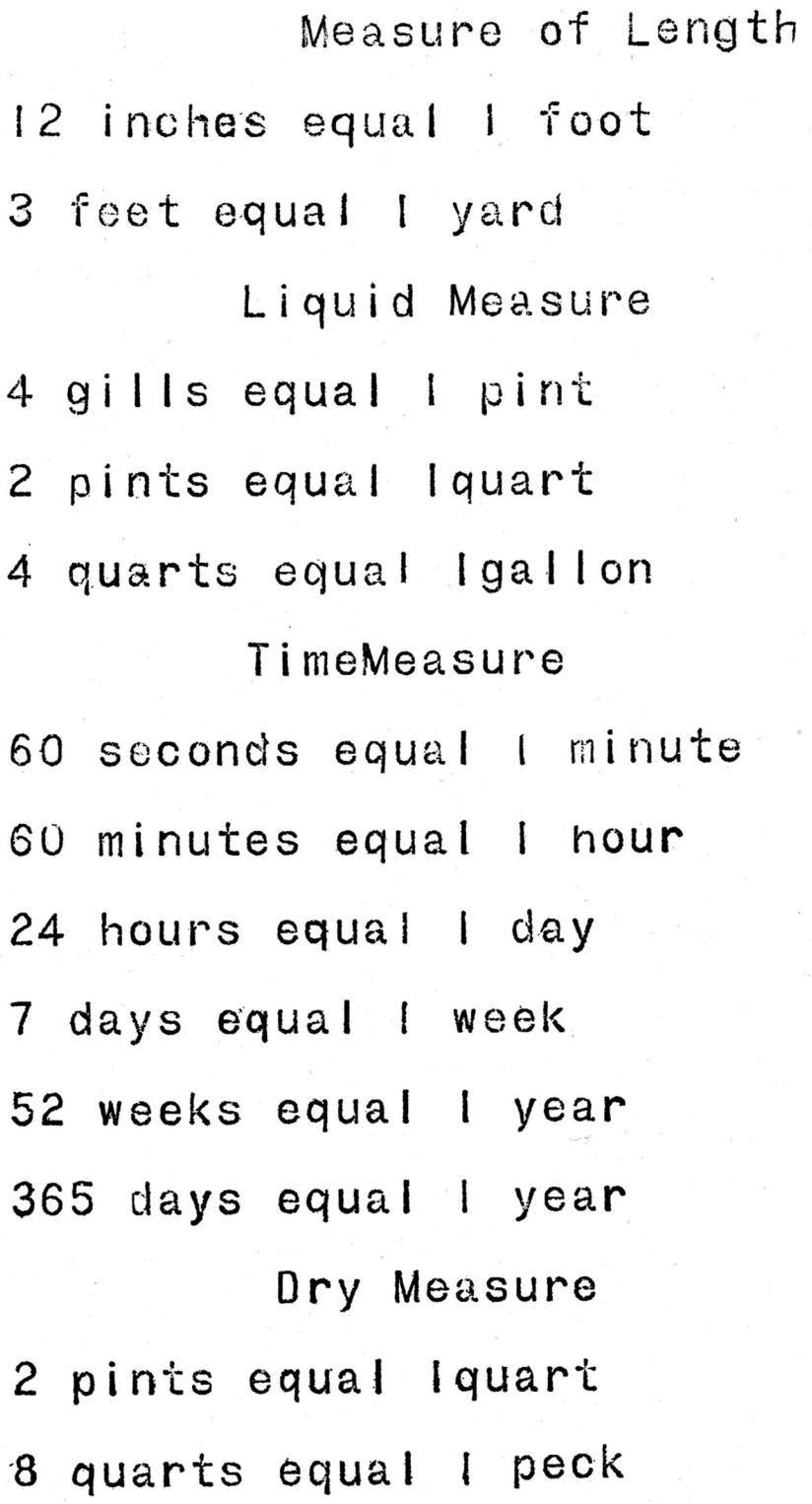
The typewriter reduces arithmetic errors. Several teachers report that the typewriter reduces errors due to misplaced numbers, and to mistaking one number for another. Errors are more readily detected by pupils, when arithmetic work is typed, because of the clearer images and the more orderly arrangement.

3 The typewriter helps in careful, orderly, particular arrangement of work on the papers. It aids the children in detecting their own errors more readily, because of the clear visual image that it provides. Children are very proud to have their typewritten arithmetic work displayed on the bulletin board.

3 It eliminates to a large extent mistakes due to misplaced numbers. It eliminates mistaking one number for another. It stimulates thinking in producing signs such as: $\times$, $+$, $-$, $=$.

4 The typewriter encourages straight columns and careful work in arithmetic.

The typewriter motivates writing original arithmetic problems. A few teachers mention the fact that some of their children made up series of original arithmetic problems, which they typed, and often put to-



FACSIMILE OF AN ARITHMETIC EXERCISE DONE IN A SIGHT-SAVING CLASS

This paper was prepared by a 6B pupil who had used the typewriter for one semester. A machine equipped with bulletin size type made possible the large letters and numerals.

gether in the form of booklets. A larger number of teachers mention the willingness of the children to do drill work on the typewriter.

3 The typewriter has motivated the writing of original problems.
3 The machines have helped in drilling on tables and making original story problems.
3 The typewriter is a means of providing supplementary drill, as the children like to make up and solve their own number problems on the machines.
4 The children have more interest in learning and drilling on difficult number relations when they are allowed to type them.
6 The children have made booklets of original arithmetic problems.

The Typewriter and Handwriting

Chart 45 indicates that there is less agreement among the Experimental teachers regarding the influence of the classroom typewriter on handwriting than on any of the other subjects. From December 1929 to May 1931 the proportions of teachers giving favorable judgments decrease, and the proportions of those giving judgments which have been classified as unfavorable increase. Most of the answers which we have classified as unfavorable are largely statements to the effect that the typewriters have lessened the amount of handwriting practice, rather than judgments that the quality or rate of handwriting has been observably lessened by the use of the typewriters. More than half of the teachers in May 1931, after two full years of experience with the classroom typewriter, either fail to answer the question, or say that there has been no observable effect on handwriting. The test evidence presented in Chapters II and III, and the data on quantity of handwritten work done by typewriter classes presented

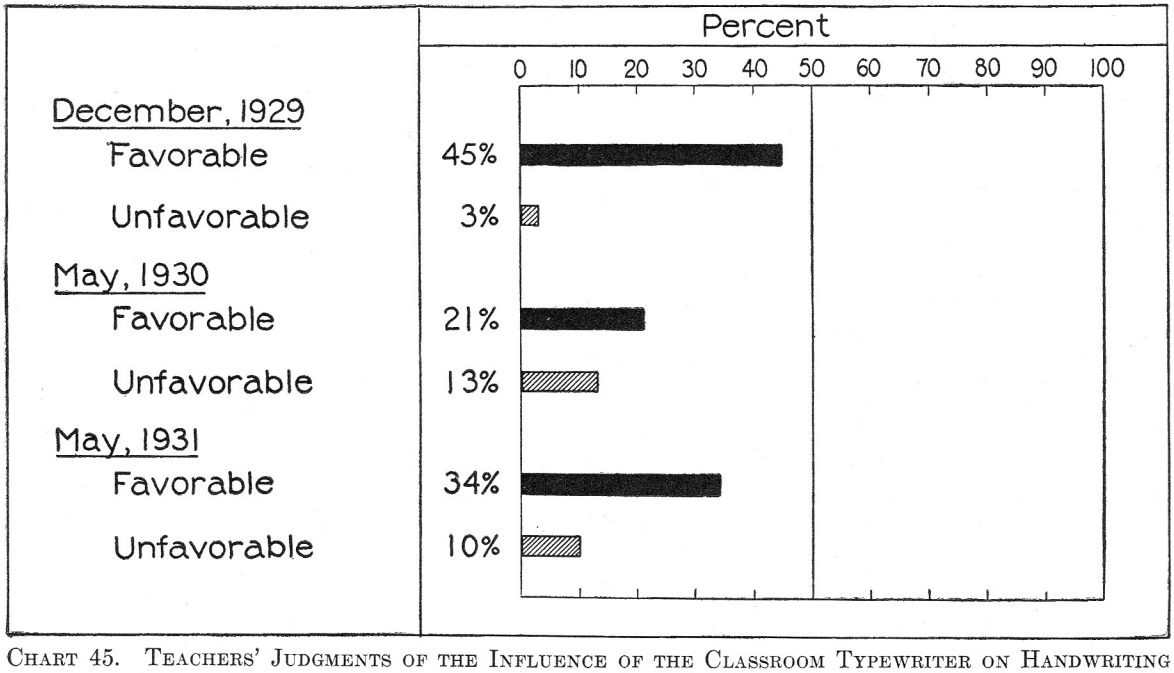


Chart 45. Teachers' Judgments of the Influence of the Classroom Typewriter on Handwriting

The black bars show the proportions of teachers that judged the typewriter had favorable influences; the cross-hatched bars show the proportions of teachers that reported unfavorable influences. The chart is based on the returns from the questionnaires answered in December 1929, May 1930, and May 1931, by the 116 teachers who had two full years of experience with the typewriter. The percentage of teachers that failed to answer is the difference between 100 per cent and the sum of the percentages of favorable and unfavorable answers as shown on the chart.

in Chapters IV and V, together with the fact that three times as many teachers give favorable as unfavorable judgments, lead us to believe that there has been very little, if any, undesirable influence; and that the weight of the evidence favors the conclusion that the influence of the classroom typewriter on handwriting has been educationally desirable. The need for further research, however, is obvious. Since our main interest is in ultimate effects, on the attitude toward writing no less than on the skill and precision of muscular coördination indicated by the speed, legibility, and neatness of handwriting, it would be desirable to study the children in the typewriting classes for several years, taking annual measurements with complete batteries of achievement tests, including handwriting quality and rate tests. The 1935 status of the children who began the use of the typewriter in the kindergarten and first grade in September 1929 would throw real light on the problem.

The following groups of excerpts illustrate the types of favorable answers given by the teachers to the question regarding the influence of the classroom typewriter on handwriting.

The typewriter aids children in early stages of handwriting. The judgments of kindergarten and early grade teachers are of special interest, because of the widely recognized desirability of simplifying the early stages of learning to write. According to some of these teachers their pupils show an increased activity in printing and in manuscript writing, and more accurate appreciation of the formation of letters; the use of the space bar on the typewriter leads them to an earlier appreciation of the necessity of separating words; the neatness of their typing tends to carry over to their handwriting.

Kdg. Typewriters cause an increased interest in printing and manuscript writing as the children want to be able to print the words they write on the typewriters.

Kdg. With type constantly before them there has been more careful noting of the formation of letters, imitation, and accuracy, in making them.

Kdg. Because of the similarity between typing and manuscript writing, the letters are more readily recognized. Children have less difficulty in remembering to leave a space between words.

1 Typing helps handwriting in the very beginning by familiarizing the children with the forms of letters very similar to the manuscript letters.

1 Typewriting improves handwriting. The child realizes that a good typewriting paper has an even margin, is neat and perfect; hence he tries to make his writing paper so.

2 The typewriter may have some influence on spacing. I believe there is a "carry-over" (they use manuscript). On asking a small child to spell her name, I received this reply, "Capital R-u-t-h space Capital T-a-y-l-o-r."

The typewriter improves handwriting in intermediate grades. A few of the teachers in the intermediate grades say that the typewriter increases the amount of handwritten work (cf. Chapter V), and that the good form which they achieve in typewriting tends to improve their handwriting form.

3 The amount of handwriting is increased as majority of children write stories first by hand before typing. The neatness of appearance of typed copy works for more neatly handwritten papers.

3 Typewriters have taught the children to take greater pride in the appearance of their papers — making correct margins and paragraphs.

3 The typewriter stimulates more practice in handwriting as the children like to write a story in longhand, have it corrected, and copy it on the typewriter.

5 Has been detrimental to a few poor writers; has been a decided help to others to be able to see a neatly typed page. Has had no ill effects on the great majority.

5 The handwritten papers as a rule have been neater, more legible. There is less

blotting or crossing out, as they don't do so on the typewriter.

The typewriter reduces the amount of immature and hasty practice in handwriting. A few teachers express satisfaction with the fact that the typewriter releases children from sole dependence on handwriting as a medium of written expression, and suggest that in thus lessening hasty and often careless handwriting, the typewriter effects a wholesome restraint in handwriting efforts.

Kdg. I am not sure but that the typewriter wholesomely retards immature efforts of self-expressive scribbling until there is a biological and neurological fitness for real writing. With the children under observation this has been most gratifying. When writing is finally attempted there is a keenly aroused appreciation of the *form* of individual letters.

1 By lessening the amount of handwriting necessary, it makes possible closer supervision until good writing habits are established. With manuscript writing it helps children in spacing between words. Children who use typewriters are less likely to be satisfied with a paper which they cannot read.

2 Through working off long stiff jobs on the typewriter, a tendency toward careless and hasty handwriting has been obviated. Thus the handwritten papers have been fewer and the emphasis on careful handwriting has been increased.

5 Children do less handwriting but are more painstaking. The arrangement on their papers is neater.

Children prefer typewriting to handwriting. The fact that some children prefer the typewriter to the pencil is mentioned by a few of the teachers.

1 It seems that those who type fairly well are impatient of handwriting.

1 Children care less for handwriting. I feel that this is due to the fact that they can cover much more ground in a much shorter space of time on the typewriter.

1 For many children handwriting seems like work, while typewriting seems like fun.

5 Nine out of ten prefer to typewrite. Does not improve handwriting.

6 Children prefer typing to handwriting. Does not actually improve handwriting.

The typewriter is an incentive to good handwriting. The following excerpts are reproduced more to reveal one of the important conditions under which the experiment was carried out in some of the schools than as evidence on the question under consideration. The problem of incentives and rewards and prohibitions is too complex pedagogically and philosophically for consideration in this report.

1 The typewriter served as an incentive to good handwriting because the machines might not be used by an individual whose handwriting fell below his normal ability.

2 The handwriting must show an improvement or the class is not allowed to use the machines.

3 Children are eager to improve their handwriting so that they will be permitted to spend more time typing.

3 The typewriter has raised our standards of handwriting, for anyone with poor handwriting may not use the typewriters until he has pulled it up.

4 Typewriters have been used as an incentive to write better. Poor writers have been allowed to use the typewriters when writing has improved.

4 Pupils are more careful of handwriting so that they may be able to use machines. A mother promised her daughter a typewriter if she kept her handwriting up to standard.

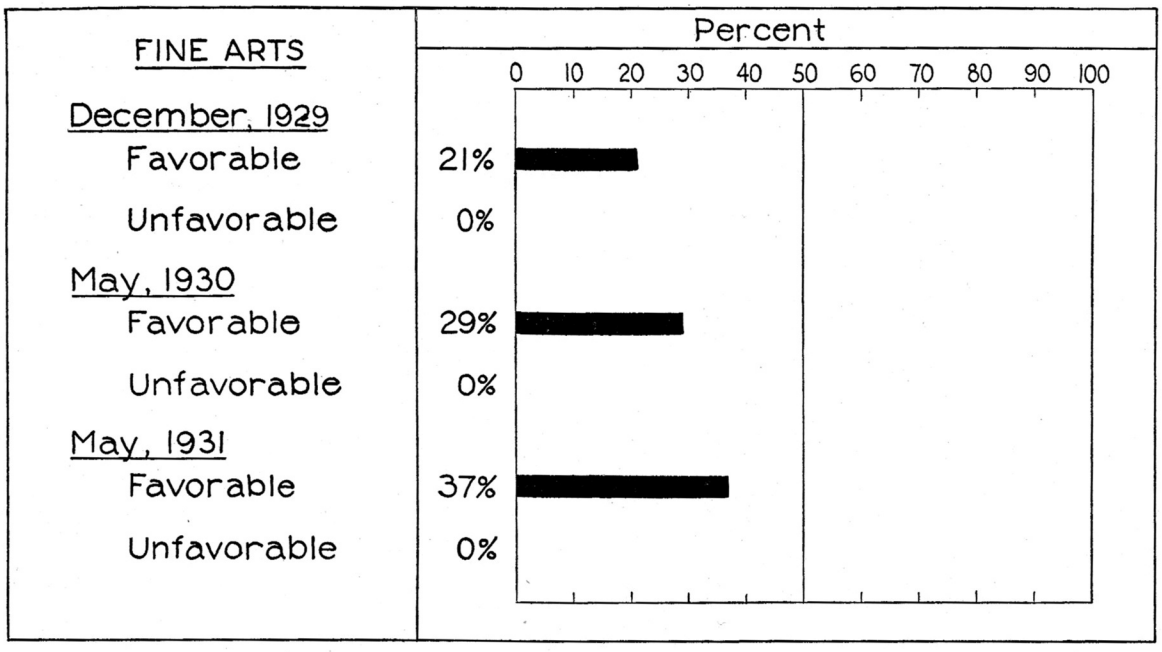
6 Children prefer to type. Allowing children to type careful handwritten papers proved an incentive for better handwriting.

The following excerpts illustrate the types of answers that have been classified as unfavorable.

4 The extra time given to typewriting has taken part of the handwriting time and in that way the effect has been bad.

4 The actual effect on handwriting is poor, because of the fewer opportunities for practice. However, in the case of children who are very poor writers, it is good, because the permission to use the typewriters can be given as a reward for improvement.

5 No effect, unless negative, because the time now devoted to typewriting would otherwise be given to handwriting.



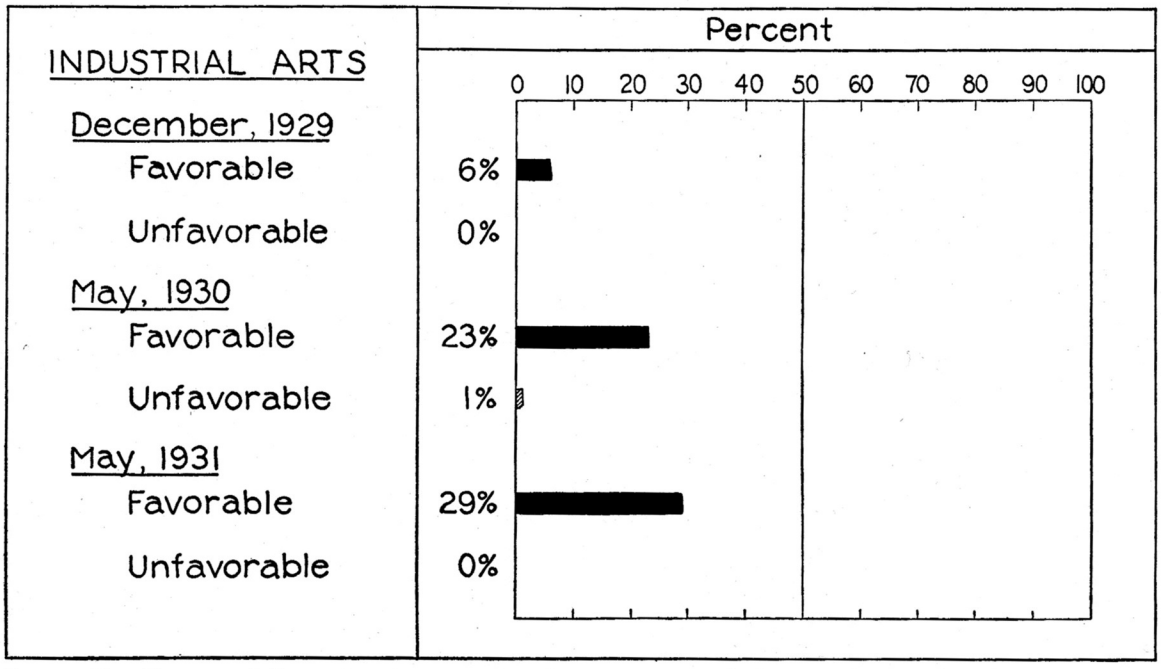


CHART 46. TEACHERS' JUDGMENTS OF THE INFLUENCE OF THE CLASSROOM TYPEWRITER ON FINE ARTS AND ON INDUSTRIAL ARTS

The black bars show the proportions of teachers that judged the typewriter had favorable influences; the short, cross-hatched bar shows the proportion of teachers that reported unfavorable influences. The chart is based on the returns from the questionnaires answered in December 1929, May 1930, and May 1931, by the 116 teachers who had two full years of experience with the typewriter. The percentage of teachers that failed to answer is the difference between 100 per cent and the sum of the percentages of favorable and unfavorable answers as shown on the chart.

The Typewriter and Industrial and Fine Arts

In December 1929 very few teachers noticed any connection between typewriting and industrial arts; and only 20 per cent mentioned positive influences of the classroom typewriter on the children's work in fine arts. But, as is shown in Chart 46, the numbers of teachers who report positive benefits increased substantially as their experience with the classroom typewriter increased. No negative influences are reported except by one teacher on the May 1930 questionnaire. She says that her kindergartners spent so much time at the typewriter, they neglected their industrial and fine arts work. A year later, on the May 1931 questionnaire, this same teacher notices the same influence on her new class of kindergartners, but only "at first"; that is, when they first began to use the machines. During the second semester, she noticed no undesirable effects.

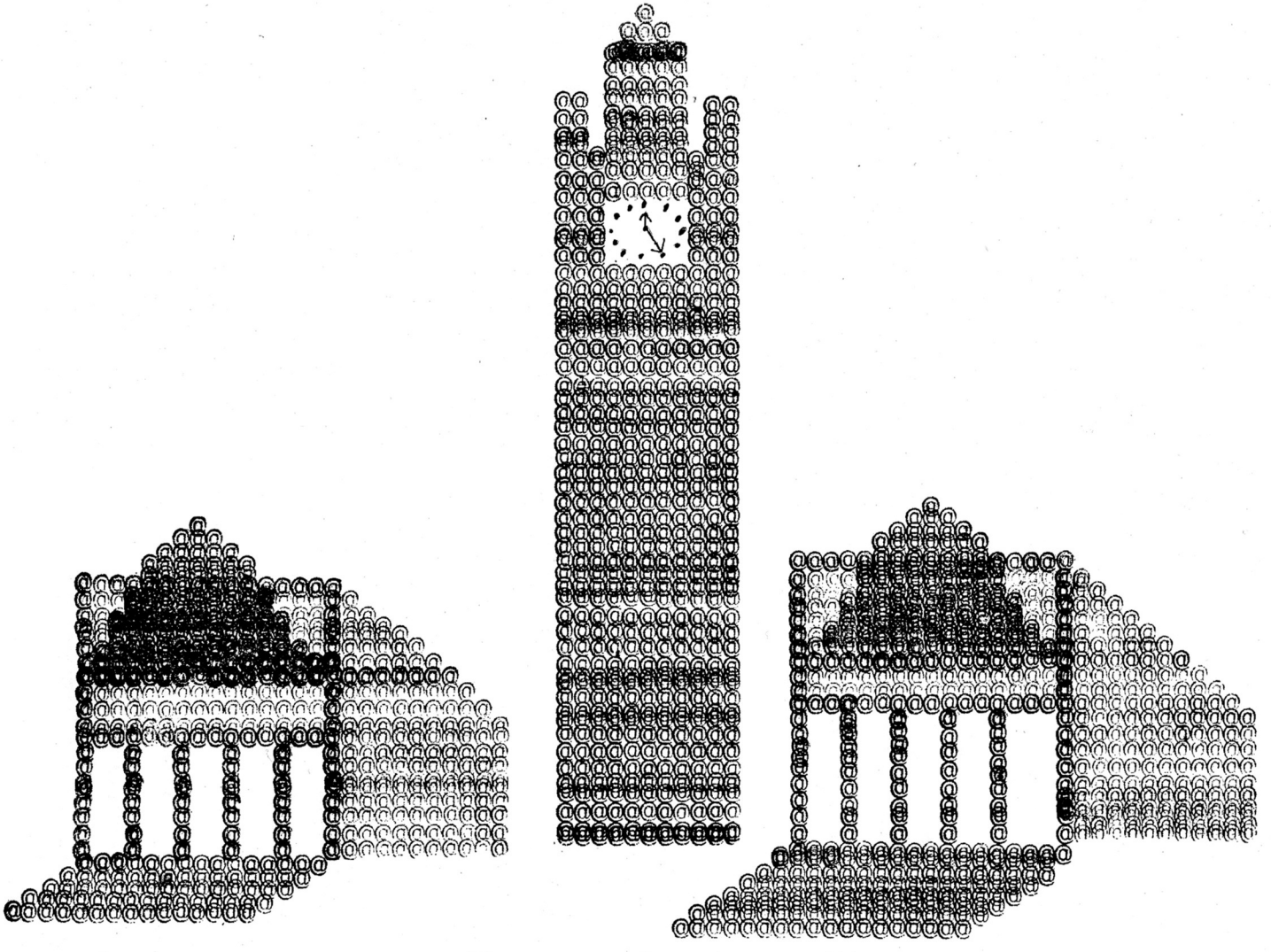
At first thought it may seem that the possible influence of the classroom typewriter on elementary school work in industrial and fine arts would necessarily be remote and small. What possible effect, one might reasonably ask, can typing have on sewing, basket-making, clay modeling, cookery, building, making looms, nature study collections, painting, drawing, etc.? The *apparent* remoteness of typing to these activities accentuates our interest in knowing just why the teachers judge the typewriter to have had a desirable influence on the art work of their pupils, and what kinds of evidence and concrete observations they offer in support of their favorable judgments.

The typewriter improves correlation of art and language work. Children have a natural interest in talking about, naming, and labeling the objects they make, the museum and nature study exhibit pieces they collect, the pictures they paint or draw, as well as in telling or writing the stories about their experiences in making the objects or the stories they imagine about their pictures and drawings. Many teachers say that the typewriter enables them to take advantage of this natural interest of the pupils, thus securing more language work without extra effort, and with increased satisfaction in both art and language work.

Kdg. The children have a strong desire to label things; interest in seeing the word for the thing that has been made. All quickened by the use of the typewriter.
1 Type labels to tell what things are.
1 Typing stories of experiences in cooking, building, trips, etc.
1 The children type labels for some of their hand work, for things in the museum, for their names on clay work.
1 The typewriter has been a means of correlation. We have studied pictures, imagined stories about them, and typed the stories. We have illustrated stories or poems the children have copied. These have been used for our bulletins such as "Stories We Like" or "Poems We Like."
3 Increased interest in "Picture Study" lessons when pupils know booklets were to be typed. Pleasure in typing poems and songs which is an uninteresting task when written by hand.
3 Typing stories of experiences, such as making looms, washing wool, weaving, knitting, in study of wool.
6 I find wonderful correlation of art and other subjects. Book covers for history, reading, and art booklets, etc.

The typewriter increases interest in drawing. Several teachers report that the better correlation of language and art work made possible by the typewriter increases the interest of the children in art work.

Kdg. Children are more interested in drawing when it means illustrating a typed story. By illustrating their typewritten pages, children have shown a renewed interest in drawing.
2 Drawings are made more meaningful by typing a sentence or story about the picture below it. Children enjoyed drawing clock faces with Roman numerals.



FACSIMILE OF A DRAWING DONE DIRECTLY ON THE TYPEWRITER

This piece of work was done by a fourth-grade boy. It represents the group of municipal buildings in the city in which he lived. The work was done entirely with the @ character, and without the guidance of any lines on the paper.

In some cases they have written a sentence telling what time it was.

2 A desire to make original designs for wallpaper and rugs, using the two colors. A means of making plans for any unit work or in planning a school flower garden. Designs for book covers.

3 Since more stories have been written by the children and the common practice seems to be to illustrate these stories, there has been more drawing and painting.

3 In illustrative seat work it tends to evoke free expression in accompanying typewritten material.

The typewriter enhances booklet making. Many teachers report that the typewriters increase the activities in making booklets of all sorts, improve the quality of the booklet and map work, and increase the satisfaction and sustain the interest of the children.

1 The typewriter is useful as an aid in writing labels, signs, names, and greetings to put on some of the work in Fine Arts. Sometimes a few words on a page that has a picture pasted on help to make an interesting booklet, when several pages are fastened together. The single page can be put into the typewriter, otherwise the name or greeting has to be pasted on, and the children do not like that so well.

1 Children have made interesting booklets of various subjects more neatly with the typewriter than by handwriting as in other years when typewriters were not available.

1 Used for labeling boxes, making telephone screens, and for titles of books. Used in making story books. Used in making stories to explain pictures for books.

2 The children in this room have written a newspaper each week this semester. It has been an incentive to work of all kinds as the child doing the best work in each subject acted as reporter.

2 The making of booklets has been very interesting. The use of the typewriters has made this work more attractive.

2 The typewriter sustains interest in making booklets longer. I find this true in art work also.

3 Typewriting leaves room on papers, therefore papers can be made brighter by illustrations.

4 The typewriter increases the desire to illustrate poems and stories, both copied and original.

4 Search for pictures to illustrate poems has led to a keener interest in and appreciation of pictures. More and better illustrations accompany poems and stories.

6 It has helped us to make a magazine. Each child has contributed something. Too many different types of handwriting would not look as well.

6 A keen interest in freehand drawing of maps. The names of all places neatly typewritten.

6 Label models of cross-sections of surface of U. S. and place names of products on these models. This adds much to appearance of work.

The typewriter awakens sense of design. Many teachers report that the typewritten page has inspired children to improve the neatness and arrangement of their written work in general. This effect appears also in art work in the form of greater precision of drawing and a better sense of proportion, balance, and rhythm in design. Of extraordinary interest, however, is the fact that many children have made designs and pictures of considerable artistic merit directly on the machines. The adaptability of the machine for making straight lines of characters, of variable length, and at various angles (by varying the lateral and vertical spacing), and the possibility of shading (by varying the force of striking the keys and by over-typing), have been discovered by many children and have opened up new fields for artistic adventurings which in some cases have produced extraordinary results.

Kdg. Children have frequently typed names of the pictures they have painted and colored. In placing these labels on the object, they have developed some sense of balance and arrangement.

2 Appreciation of beauty in a nicely arranged and artistic page is noticeable. Imagination and execution along artistic lines are the two outstanding effects.

2 The typewriter is developing artistic talent in making, with certain letters or characters on the machine, pictures of objects, such as animals, people, buildings, furniture, trains, boats, etc.

3 Children's artistic ability is developed by making designs and sketches on machines.

4 The work of arranging the subject matter on the page gives the pupil a better sense of proportion and rhythm.

5 Some children prefer to make interesting little designs, by using the period or some letter, for booklet covers. In the month of February a few children made log cabins, using keys like *x* or the dash. We have the use of the typewriters for art appreciation lessons too.

6 The Art Supervisor has remarked on the ability of the children to arrange their art work with more regard to beauty of proportion than usual. Of course the beauty of the little machines appeals to the children. Some of them have special colors. The other day one row was very pleased to have an orchid machine on every desk in the row.

CHAPTER VIII

TEACHERS' OBSERVATIONS ON THE TEACHING AND MANAGEMENT PROBLEMS OF THE CLASSROOM TYPEWRITER

Introduction

In each of the three questionnaires described in the two preceding chapters, questions were included on various aspects of the pedagogical and administrative or classroom management problems which developed in connection with the use of the classroom typewriter. These problems are treated at length in Dr. Haefner's book,[1] and it is not our purpose to discuss them here, but rather to present the answers of the teachers to some of the questions as a means of throwing further light on some of the significant conditions under which the experiment has been carried forward. Our presentation will be confined to the answers of the 116 two-year teachers to the questions in the May 1931 questionnaire.

Teaching Problems

Teaching children at the machines. The question on teaching problems was worded as follows:

List the teaching problems in connection with the typewriter which have been most difficult to solve in your room. Suggest any ways in which these problems might be more satisfactorily solved.

In May 1931, 38 per cent of the 116 teachers either failed to answer the question or reported that they had encountered no difficulties important enough to mention. The problem most frequently mentioned by the other 62 per cent of the teachers was that of teaching the children at the machines. The specific nature of the difficulty was occasioned by the fact that while one-third or one-fourth of the pupils, depending upon the number of machines in the classroom, were working at the typewriters, the teacher was busy with the other two-thirds or three-fourths of the students in another part of the room. The children at the typewriters would frequently demand help from the teacher, and their demands were almost always of a very insistent sort. It was characteristic of the children when working at the machines that their desire for help was inspired by a genuine "felt need," and since many of the children were often writing far beyond their normal vocabulary and spelling experience, they had many felt needs. It was this aggressive desire to learn, and the frequently insistent nature of their requests for help, that made the teachers feel this to be a serious problem.

It must not be understood that the teachers disapproved of this new attitude of the children toward learning. On the contrary, the teachers cited this as one of the most valuable influences of the typewriter. Nor did all of these teachers list this problem as a very difficult one. Most of them apparently mentioned it for the purpose of telling what methods they had found to be most satisfactory in meeting the opportunity presented by the children's desire to be instructed. Some of the teachers said that meeting the demands of pupils at the typewriters was one of the things that increased the pleasure of teaching. The

[1] *The Typewriter in the Primary and Intermediate Grades*, by Ralph Haefner, Macmillan, 1932.

pupils' questions were practically always very specific and could be answered very quickly without any serious interruption of the work with the other pupils. Only seven of the 116 teachers said that this new thirst for knowledge on the part of the pupils required so much of their time and attention as to constitute a serious problem. Most of the teachers simply considered the group at the typewriters as a part of the larger group that they were instructing in another part of the room. Many of the teachers reported that they made use of the brighter pupils in the room to help answer the questions of some of the children at the machines.

Introducing the children to the machines. Most of the children learned the essentials of operating the typewriters from the introductory lessons which the teachers gave in accordance with the directions in the Experimental teachers' manual reproduced in Chapter I above. (See page 12.) As would be expected, however, a few of the children continued to have some difficulties in operating the machines for some time after the majority of the students were able to get along satisfactorily. Most of the teachers met this problem satisfactorily by having the students who were most advanced in the use of the machine help the less apt students; but some of the teachers suggested that this problem could be most satisfactorily met by a more formal method of introducing the typewriters to the pupils, and by continued systematic instruction in typing as typing.

In order to secure the teachers' judgments on the merit of this suggestion, a question on the desirability of a more systematic method of instruction was included in the May 1931 questionnaire. Fifty-six per cent of the teachers said that a more systematic method would be very desirable, 34 per cent said it would be of doubtful value, and 4 per cent said that formal, systematic instruction in typing would be highly undesirable. Since this important problem is discussed fully in Dr. Haefner's book, it will not be discussed further at this point. As indicated above, our purpose in summarizing the teachers' answers to these questions is to describe some of the important conditions under which the experiment was carried out.

A teachers' manual on the use of the classroom typewriter. In the May 1931 questionnaire the teachers were asked to express a judgment as to the value of a comprehensive treatise on the pedagogy of the classroom typewriter. Sixty-six per cent of the teachers replied that such a treatise would have considerable value, and 26 per cent said that it would have some value. Eight per cent of the teachers gave no answer or said that such a treatise would have little value. It was in answer to the need implied by the answers of 92 per cent of the teachers that Dr. Haefner has written his treatise on the pedagogy of the classroom typewriter.

Pupil's practice book. The pupils had little difficulty in finding something of interest to themselves to do on the typewriters. Many of the teachers, however, reported that sometimes they chose pieces to copy which were too difficult or which otherwise were not adapted to their needs. Some of the teachers suggested that a carefully selected and graded set of exercises for the students to copy on the machines would help the pupils both in mastering the typewriter and in furthering their educational development. In order to secure the judgment of all the teachers on the value of this suggestion, the question was included in the May 1931 questionnaire. Forty per cent of the teachers said that a pupil's practice book would be of considerable value and 28 per cent said it would be of some value. The remaining teachers said that

such a book would have little value. Some of the teachers who said that such a book would be of little or doubtful value were motivated by a fear that with such a book the work at the typewriters would become too highly formalized. One of the outstanding features of the children's work at the typewriters during the experiment was the freedom and informality which characterized it. To most of the teachers, however, it seemed that such a book could be used as a guide, but would not have to be followed so closely as to destroy the interest and freedom of the children.

Lower case *versus* capitals on the keyboard. Early in the experiment many of the teachers in kindergarten and the early grades reported that pupils were confused by the fact that the letters on the keyboard were capitals whereas the children were most familiar from their reading with the lower case letters. It was also somewhat disconcerting to the younger children to strike a key with a capital letter on it, and produce a lower case letter. Many of these teachers suggested that both lower case and capital letters be put on the keys, and others suggested that only lower case letters be placed on the keys. In order to secure the judgments of all the teachers on the merits of these suggestions, a question was included in the May 1931 questionnaire. Sixty-three per cent of the 116 teachers gave the judgment that both capitals and lower case letters should be put on the keys. Twelve per cent voted for lower case alone, and 17 per cent were satisfied with capitals alone. Eight per cent gave no answer. These last two groups of teachers were, of course, upper-grade teachers.

Size of type. In answer to a question in the May 1931 questionnaire relating to the most desirable size of type, 60 per cent of the teachers preferred primer type, and 40 per cent preferred pica type. As might be expected, all of the kindergarten and early grade teachers preferred primer type, and only teachers in the second grade and above preferred pica type.

Numbers of machines. It will be recalled that the ratio of the number of machines to pupils was about one to four throughout the two years of the experiment for all schools together, but the ratio varied from grade to grade and from school to school. In the May 1930 questionnaire 50 per cent of the teachers said that they had too few machines in their classes for satisfactory work, 44 per cent said they had about enough machines, and 3 per cent said they had too many.

In the May 1931 questionnaire the teachers were asked to indicate the ratio which they thought best for their respective grades. Twenty-two per cent of the teachers thought a ratio of one machine for each child was the most desirable. Twenty-five per cent thought that one machine for two children was sufficient. Thirty per cent thought that a ratio of from one to three to one to five would be most satisfactory. Ten per cent of the teachers preferred a ratio of one to six, and another 10 per cent preferred ratios of from one to seven to one to twelve. The lower ratios, of course, are preferred by the kindergarten and early grade teachers, while the higher ratios are preferred by the teachers in the upper grades.

Classroom Management Problems

Arranging turns at machines. In the May 1931 questionnaire, 16 per cent of the teachers mentioned the arrangement of turns at the machines for the children as constituting an important classroom management problem in connection with the use of the typewriters. Eighty-four per cent of the teachers apparently solved this problem so satisfactorily that they did not mention it as a problem at all. Even some of the

16 per cent of the teachers who did mention it as a problem reported satisfactory solutions. Several of these teachers reported, however, that it could not be satisfactorily solved unless the number of machines was increased, or unless the typewriters from various classes were placed together in a separate classroom so that all the children from each class could use the machines simultaneously at scheduled periods. The various ways in which the great majority of the teachers solved the problem are discussed fully in Dr. Haefner's book.

Moving the machines. As indicated in Chapter I, the machines when not in use were stored in steel cabinets or in specially constructed wooden cabinets. In one or two centers the wooden cabinets were constructed in the high school manual training shop. This method of housing and safeguarding the machines created the necessity of moving the machines from and to the cabinets. In many of the classrooms the machines were also moved from the desks of one relay of students to the desks of the succeeding relay of students who worked at the machines. In May 1931, eight of the 116 teachers mentioned the moving of the machines around the room and from and to the cabinets as a problem. More than 90 per cent of the teachers found this problem to be easily solved by appointing some of the stronger students as class monitors to take care of the moving of the machines. In the kindergarten and first grade there were some classes that did not have children large enough to handle the machines safely. In such cases children from higher grades were appointed to care for the moving of the machines. This led to an interesting and genuine type of inter-class coöperation and civic training which was favorably commented upon by many of the teachers. Since tables were usually used in the kindergarten and early grades, and since there were only a few machines in each of these lower classes, the machines could be left on the tables throughout the school day, so that the moving problem was confined to taking the machines from the cabinets in the morning and returning them to the cabinets in the afternoon.

Where to use the machines. The question of where to use the machines was brought up by some of the teachers in relation to several other classroom management problems. As noted above, some of the teachers suggested that the problem of arranging turns at the typewriters could be solved most satisfactorily by having a separate typewriter room in which all the children of a given class could use the machines simultaneously at scheduled periods. Eighteen per cent of the teachers mentioned this problem in connection with the distracting effect of the noise of the machines on the teacher and on the pupils who were being instructed in another part of the room. The elimination of noise was mentioned as an important advantage of having the typewriters in a separate room. A large number of teachers, however, thought that having the typewriters in a separate room would be unfortunate for the reason that it would mean a fixed schedule for typing and would tend to break up the informality and freedom which characterized the use of the machines in the classroom. Some of the teachers preferred to have the machines used on the pupils' desks and others on special tables in various parts of the classroom. In order to secure the judgments of all the Experimental teachers on the merits of these various suggestions they were asked to express their judgments in the May 1931 questionnaire. Thirty-four per cent of the 116 two-year teachers preferred to have the machines used on the pupils' desks, 38 per cent preferred tables at the back or side of the room, and 2 per cent

preferred tables in the front of the room. Twenty per cent of the teachers voted for a separate room for the typewriters, and 6 per cent failed to answer the question. In general the kindergarten and lower-grade teachers preferred special tables in the classroom, while the upper-grade teachers preferred to have the machines used on the pupils' desks. The teachers who voted for separate typing rooms were all in the upper grades.

As indicated in a preceding paragraph, 90 per cent or more of the teachers found the arrangements for housing the machines quite satisfactory. Some of the teachers, however, suggested that equally satisfactory housing arrangements might be made while eliminating the problem of moving the machines entirely, by placing the machines permanently in specially constructed desks. The machines would thus be used and stored in the same place. Several school furniture manufacturing concerns have studied this problem and it appears that the necessary alterations to several types of standard school equipment could be made at very low cost.

The essential conditions which would have to be met by such desks may be briefly summarized. In the first place, the children must be protected from injury. Most of the designs which we have seen involve the raising of a rather heavy lid which stays in an upright position while the child is using the machine. This heavy lid might easily be pushed over by children passing down the aisle in such a way as to cause it to fall shut, which would mean that it might fall with great force on the child's head or forearms. This danger can be removed by providing a double safety snap lock which will hold the lid firmly in an upright position. In the second place, the machines must be protected from theft. This can be done by locking the machines to the base of the desk in such a manner that they can be easily removed by authorized persons for repair or other purposes. In the third place such desks should either reduce or at least not increase the noise made by the machines when in use. The tops of the desks, being in an upright position while the machines are in use, may act as sounding boards, unless they are constructed with acoustic considerations in mind. In the fourth place, if these special typewriter desks are to be used also as the regular desks for some of the children, they must provide space for storing the books and papers of the children. But, in the last analysis, only careful experimentation under practical school conditions can give trustworthy suggestions as to the most advantageous specifications for furniture to be used in rooms equipped with classroom typewriters. As already indicated, the arrangements used in this experiment proved quite satisfactory to the majority of teachers.

Burdens imposed by experimental requirements. It is apparent from the preceding paragraphs that the great majority of the teachers successfully solved the teaching and management problems connected with the use of the typewriter in the classroom. In connection with the answers of those teachers who found the solution of some of these problems very difficult, it is only fair to say that all difficulties were exaggerated by the rigorous requirements of the experiment. Many of these burdens, being imposed solely by the experimental requirements, would be absent from the normal use of the classroom typewriter under non-experimental conditions. One of the most unpleasant burdens imposed by the experiment was the collection and saving of the children's writings. This task not only constituted a heavy routine burden for the teachers, but frequently created unpleasant reactions in pupils who wanted to take

their written pieces home to show to their parents. The administration of the large numbers of standardized and special achievement tests, the answering of the many questionnaires, and the keeping of extra records, undoubtedly tended to make the inherent problems of the classroom use of the typewriter much more serious than they would otherwise have appeared to be. It is therefore believed that in judging the attitude of the teachers who found the teaching and management problems difficult, the influence of these abnormal burdens on their attitudes should be kept in mind.

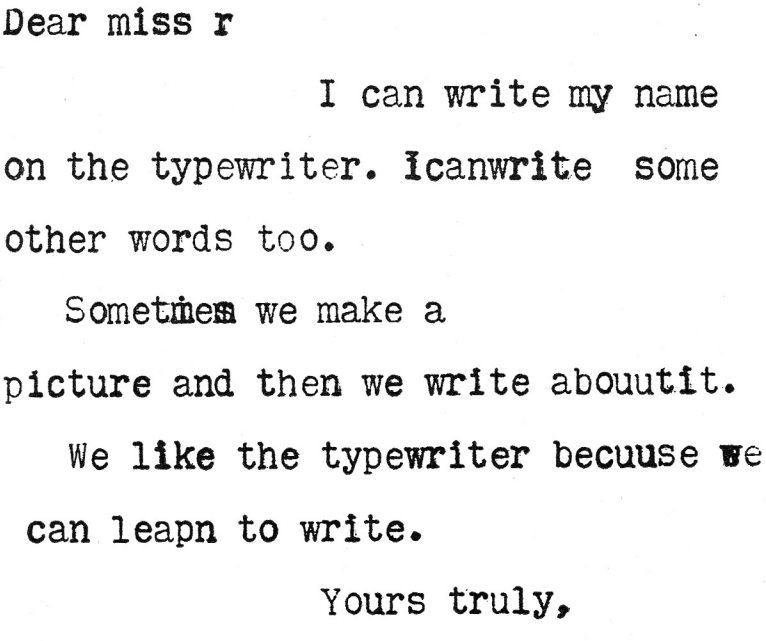
CHAPTER IX

CHILDREN'S ATTITUDE TOWARD THE CLASSROOM TYPEWRITER

Introduction

In the last few chapters considerable indirect evidence on the attitude of the children toward the typewriters has been presented. The larger quantity of writing done by the Typewriter children discussed in Chapters IV and V, and the teachers' judgments on the attitudes of the pupils presented in Chapters VI and VII, give indications which agree with our own observations and with the oral testimony of the pupils given to us while visiting the typewriter classrooms throughout the two years of the experiment.

In the latter half of the first year of the experiment, letter writing became a favorite activity among the Experimental children. The teachers reported that the pupils wrote letters " to everybody." Those in charge of the experiment were not neglected. We received typed letters from dozens of pupils telling us how much they enjoyed the machines, what they could do with their aid, how the machines made school work more enjoyable, and writing more satisfying,



Dear miss r

I can write my name

on the typewriter. Icanwrite some

other words too.

Sometmem we make a

picture and then we write abouutit.

We like the typewriter becuuse we

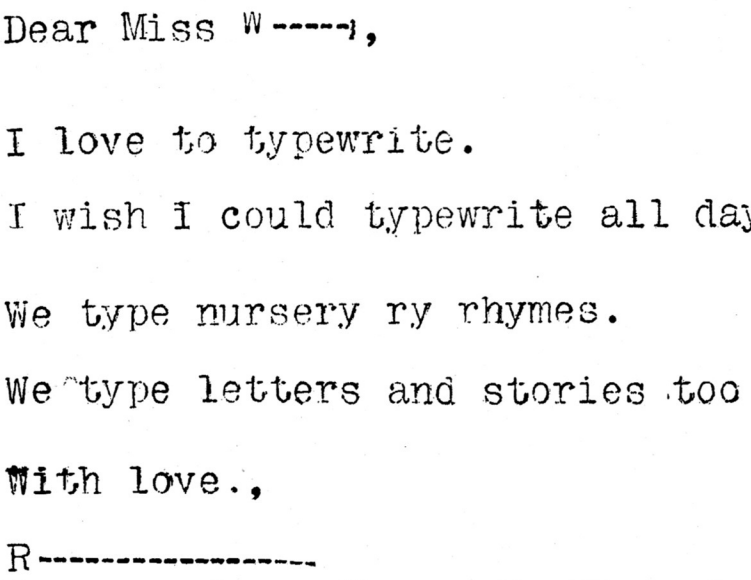
can leapn to write.

Yours truly,

V

FACSIMILE OF A LETTER TO THE PRINCIPAL WRITTEN IN MAY 1930 BY A FIVE YEAR OLD GIRL IN KINDERGARTEN

All identifying elements have been removed from this and other letters reproduced in this chapter. The young author of this letter failed to date the letter, but she wrote correctly her three names, the name of her teacher, the name of the school, and of the city and state. She also added the numeral 5 after her name to indicate her age. Note the identations.



Dear Miss W-----,

I love to typewrite.

I wish I could typewrite all day.

We type nursery ry rhymes.

We type letters and stories too

With love.,

R----------

FACSIMILE OF A LETTER TO THE PRINCIPAL WRITTEN IN MAY 1930 BY A GIRL A LITTLE OVER 5 YEARS OLD IN GRADE 1

This pupil wrote her own full name, that of her teacher, and school, city, and the state abbreviation correctly. This letter shows the influence of copying short sentences, every line beginning at the left margin.

and how ardently they hoped to have the machines another year. These letters were always written on the child's initiative, and usually with such slight provocation as to suggest that the main reason for writing was simply the desire to write.

The willingness of the children to write these letters, and the childlike candor that spiced them, suggested the desirability of securing the direct written testimony of a large number of children in all Experimental centers regarding their attitudes toward the machines. Accordingly, in May 1930, all Experimental teachers were requested to let their pupils write letters to the principal of the school, telling him all about their work on the machines, why they liked or disliked them, and whether they wanted the machines in the classroom again the following year.

Number of children's letters received. The heavy burdens of giving the final tests in May 1930, of answering the questionnaires, of arranging, packing, and shipping the children's writings, in addition to the usual extra tasks of the teachers at the end of the session, made it inconvenient for some of the Experimental teachers to carry out the request. It was for this reason also that the request was not repeated at the end of the second year. However, a total of 3020 letters written by individual pupils, and an even dozen " class letters," dictated by six kindergarten and six first-grade classes and written by their teachers, were received. All of these letters were typewritten save about five per cent of those from the upper-grade children. The handwritten letters are shorter on the average than the typed letters, and most of them mention the disappointment of the writer that the typewriters were being used by other children when the letter was written.

Table 8 shows the number and median length of all letters written by individual pupils in each grade.

Educational significance of children's letters. The general character, content,

TABLE 8

NUMBERS AND MEDIAN LENGTH OF LETTERS WRITTEN BY PUPILS IN EACH GRADE IN MAY 1930, TELLING THEIR SCHOOL PRINCIPALS OF THEIR ATTITUDES TOWARD THE TYPEWRITERS

More than 95 per cent of the letters were typed

GRADE	NUMBER OF LETTERS	MEDIAN LENGTH IN WORDS	NUMBER OF VERY LONG LETTERS
K	55	25	1 of 50 words
1	267	35	24 of 75 words
2	654	45	37 of 100 words
3	594	55	9 of 200 words
4	497	85	20 of 200 words
5	534	95	29 of 200 words
6	419	100	20 of 350 words 10 of 650 words
Total	3020		

and appearance of these letters make a perusal of them an impressive experience which cannot be adequately described within the space limitations of this report. The sheer fact that 3000 pupils in the elementary school wrote such letters at all is in itself of considerable educational significance, and is highly realistic and direct evidence of the attitude of the children toward the typewriters. This is especially true of the letters written by children in the kindergarten and early grades, where writing is ordinarily meager and not very legible. The few facsimile reproductions of childen's letters which space limitations permit us to include in this chapter afford only a very inadequate impression of the educational significance of the whole mass of letters.

THE CHILDREN LIKE THE TYPEWRITERS

The most casual perusal of the letters shows that the children are enthusiastic about the classroom typewriter. A careful tabulation of the statements made in the letters shows that approximately one per cent of the children were unfavorable in their attitude toward the machines. Some of these children mentioned several things they liked about the typewriters, but with the usual candor of children, they express their dislike quite emphatically, and usually give the reasons for their disapprovals.

No unfavorable statements were found in the letters from kindergarten, first-, and third-grade children. In the second grade, two children said they could not get their work done when they " had the typewriter to play with "; three children said they could write better with a pencil; two said they could not " make up stories " at the machine; and one said he made too many mistakes on the typewriter. In grade four, two children say they " get tired " at the machine, one complains that his machine was out of order, one says he makes too many mistakes, and four say their writing is too slow on the typewriter. In grade five, five children say they cannot write as fast on the machines as they would like, and one says the tips of his fingers get sore. In grade six, six children say they don't like the machines.

May 20,1930

Mr. G------ F., M--------, Principal

E------- F----- School

Dear Sir:

I want to tell you how much I like to write on a typewrite. I write stories, poems and rhymes. I write spelling. I write numbers.

Typewri ter is faster than handwriting. It is much prettier. It is easier to do.

I hope we have the typewriters again next year. I shall be sorry if we do not have them

Vety truly yours,

A

FACSIMILE OF LETTER WRITTEN BY A GIRL 6 YEARS OLD IN GRADE 1

Note the paragraphing and "form" that this child has given to her letter.

May 29, 1930

F

Dear Miss F-------

We like our typewriters.

We have a moth in room 10.

It is fun on our typewriters.

We can writer things on our tyepwriters.

I am glad we have some typewriters.

I do my Phonics on the typewriters.

We do meney things.

I do my ABC on the typewriters.

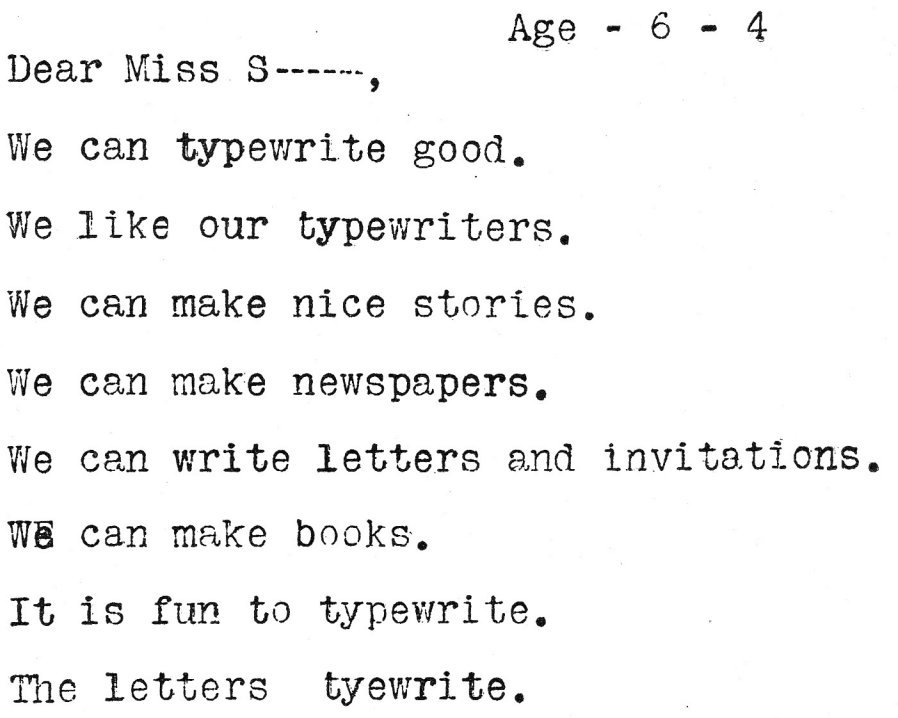
wite love to Miss F--------

6 yaar old S

H----------

FACSIMILE OF A LETTER WRITTEN BY A FIRST-GRADE CHILD AGED SIX YEARS

Note use of capitals, of period, and the general neatness of the letter.



Age - 6 - 4

Dear Miss S------,

We can typewrite good.

We like our typewriters.

We can make nice stories.

We can make newspapers.

We can write letters and invitations.

We can make books.

It is fun to typewrite.

The letters tyewrite.

FACSIMILE OF LETTER WRITTEN BY FIRST-GRADE CHILD AGED SIX YEARS, FOUR MONTHS

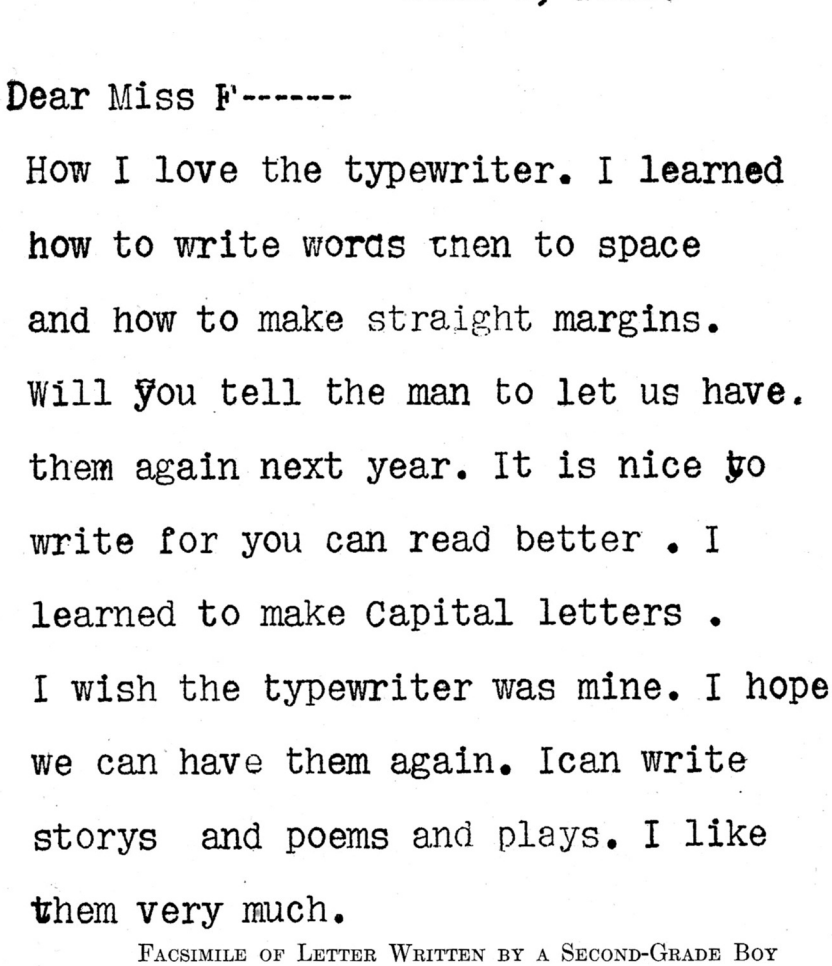
Note salutation ending with comma, correct capitalization, and correct use of the period.

These 28 statements are all those found in the 3020 letters that could be classified as unfavorable. It is not to be expected that any writing device should gain the unreserved approval of all children after only seven or eight months of experience with it. In the upper grades, where the children's handwriting habits are of long standing, it would be reasonable to expect some degree of conflict between the two methods of writing in individual cases. The fact that no difficulties are mentioned by the children in kindergarten, first and third grades, and that less than two per cent of the children in the other grades mention unfavorable reactions, is a remarkable commentary upon the adaptability of the typewriter to the writing needs of elementary school pupils.

But even more important than the small number of negative reactions is the enthusiastic liking for the machines expressed by the authors of 99 per cent of the letters. The enthusiastic attitude of the children is all the more significant because the letters show it to be not merely an emotional reaction, but a substantial attitude built up of repeated profitable experiences in which the machines have given real help in serious work. The reasons given by the pupils for liking the machines compare favorably in quality and perspective with those given by the teachers in the preceding chapters.

REASONS GIVEN BY CHILDREN FOR LIKING THE TYPEWRITERS

The numbers of reasons given in individual letters for liking the machines range from one to an extreme of twenty. Many of the children mention the novelty aspects of the machines, but by far the great majority of the reasons given are as substantial and "utilitarian" in character as those that would be given by adults. The children like the typewriters primarily because,



June 4, 1930.

Dear Miss F-------

How I love the typewriter. I learned how to write words then to space and how to make straight margins. Will you tell the man to let us have. them again next year. It is nice to write for you can read better . I learned to make Capital letters . I wish the typewriter was mine. I hope we can have them again. Ican write storys and poems and plays. I like them very much.

FACSIMILE OF LETTER WRITTEN BY A SECOND-GRADE BOY

This letter illustrates the neatness achieved by many of the early grade children after only 8 months of experience with the classroom typewriter.

in their opinion, it helps them in the serious business of doing their school work more effectively and with more satisfaction.

Younger children " can write." Most of the reasons given by children in kindergarten and first and second grades begin with the words " I can write. . . ." To these younger children, the fact of being able to write at all is the outstanding thing about the typewriters; and the fact that their writing " looks like the book " is nothing short of a wonder to them. Very few of the letters from kindergarten and first-grade children fail to mention some specific thing that the author " can write " on the typewriter.

A dozen kindergarten letters picked at random include the following emphatic assertions:

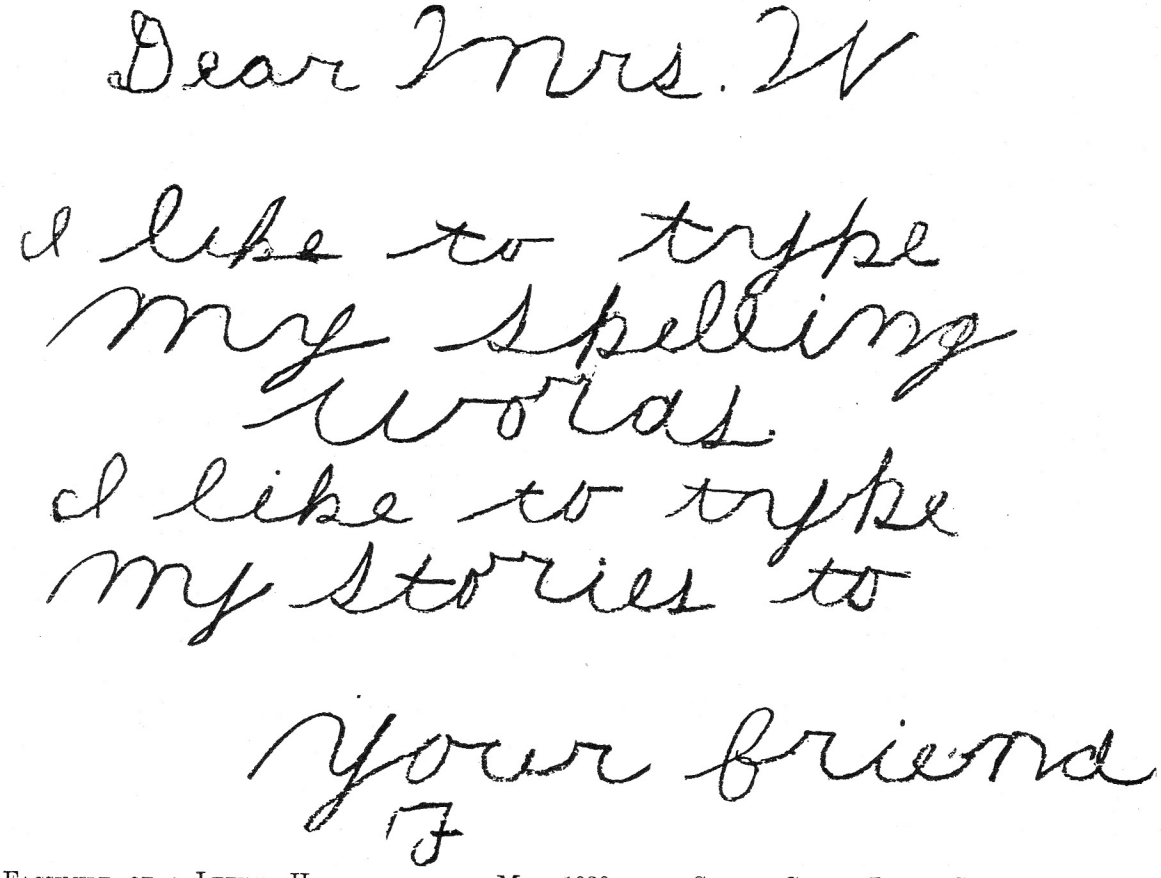
I can write like the book.
I can write A B C's.
I can write capital letters and small letters.
I can write numbers.
I can write my own name.
I can write many words.
I can write sentences.

I can write stories about pictures.
I can write riddles.
I can copy stories and poems.
I can write and copy longer stories.
I can write letters to friends.

An equal number of letters from first and second graders mention these same accomplishments and add the following:

I can write my name and address.
I can write the name of my teacher and school.
I can write my number work.
I can do phonics on the typewriter.
I write our school paper on the typewriter.
I can make up stories and poems on the typewriter.

Older children can "do everything" on the typewriters. The children in the upper grades emphasize the helpfulness of the typewriters in all aspects of their school work. In letter after letter, we find assertions to the effect that they can write longer stories, poems, and letters, and that they can do their spelling, and arithmetic, and home work better on the typewriters. Many of the children in these upper grades emphasize the helpfulness of the typewriter in their written projects of all sorts, including booklets and reports on geography, history, nature study and civics, arithmetic notebooks, the school newspaper, labeling objects in exhibits, and especially in their original composition work. The writing of spelling lists and drill exercises in language


Dear Mrs. W

I like to type
my spelling
words.
I like to type
my stories to

Your friend
J

FACSIMILE OF A LETTER HANDWRITTEN IN MAY 1930 BY A SECOND-GRADE PUPIL, SEVEN YEARS OLD

Dear Miss R---------,

I hope we can always have the Typewriters. If we can't have them in the next room Iwant to stay hear in room3. When I type I can get more words on a line and I like them because the carrier makes the margin and I don't have to think about it.

Your friend G

G----------. 7 years

FACSIMILE OF LETTER WRITTEN BY SECOND-GRADE CHILD SEVEN YEARS OLD

The advantage of the automatic margin control mentioned by this child illustrates the nature of the reasons given by many children for liking the machines. The freedom from attending to many of the mechanical details of writing is an advantage of typewriting often mentioned by both pupils and teachers.

work is frequently mentioned. Several students in the sixth grade mention the fact that the typewriter helps them in making graphs and in writing booklets of original arithmetic problems.

Typewritten papers are more satisfying. The children in all grades, from the kindergarten to the sixth grade, emphasize the more satisfying appearance of the typewritten work. In the kindergarten and early grades, the children reiterate the fact that their typewriting "looks like the book," or that it looks better. In the later grades, children say that their work looks neater and that the margins and punctuation are better. A large number of the children in the upper grades mention the fact that when they typewrite, errors are more easily seen and corrected than when they write by hand. Quite a number of these older pupils mention the fact that the typewriter "saves paper." A careful reading of the letters shows that the frequent reference to saving paper is not so much due to considerations of economy as to the fact that the compactness of typed material has a subtle attraction for the children, especially in their original composition work.

Work at the typewriter is more satisfying. Many children in all grades say that typewriting is "easier" than handwriting. Some of them amplify this statement

Dear Miss S-----,
I hope to have our typewriters next year. I like to do number work and other things.
I like to type long stories that I make up myself.
I learn more in a room that has typewriters so won't you put me in a room where there are typewriters next year?
I wish I had a typewriter at home.
Your friend.
C----------
8 years old

FACSIMILE OF LETTER WRITTEN BY A THIRD-GRADE CHILD, EIGHT YEARS OLD

by adding one or more expressions like the following: "I can write faster on the typewriter." "When typewriting, I don't get tired so quickly." "The typewriter saves so much time." The kindergarten children often mention the fact that "typing can be done any time" because "the machines are so easy to use." A kindergarten class letter dictated by the children and typed by the teacher indicates that the kindergartners learned the fundamental operations connected with the use of the typewriter quite easily. This letter contains such statements as the following: "We know how to put in the paper. We know how to return the carriage when the bell rings. We know how to shift to make numbers and capitals. We know how to make spaces, to turn the ribbon, to use both hands, to take off and put on the covers, etc."

May 21,1930.

Dear Mr. :

I suppose you would Like to know what the children in the school like and dilike about typewriting.This is my verdict. I am able to write good original letters,the teacher said she liked them,so they must be good. I don't like to write stories.Ugh! A thing I do like is arithmetic.(not when It's not on the typewriter),I Abhor Dictation.(these "dictionary words" are not so easy either. I don't like copying any too much.I like about al of the rest of the things.My account closes.

Sincerely,

June.9,1930.

Dear Mr.S-------,

I like to write on the typewriters very much. It helps me in my work. I like to do my spelling on them. I'also like to do the bank reports,letters,geography paper and History ones. Some of the children can typewrite very well. We write on them nearly every day. We have had some typewriting tests and I liked them very much. I like them because they are pretty and very helpful. We are making a newspaper and we do that on typewriters. I appreciate them very much.

C----------

8 years

FACSIMILES OF LETTERS WRITTEN BY FOURTH-GRADE CHILDREN

B-------- School

June 2, 1930.

Dear Mr. M------,

This year I have learned to do a great many things on the typewriters and I think it was very kind of you to let us have them in school.It is fun to see if you can type your name or something else looking out of the window. This is one of the things I have learned to do at school.I also learned to type the alphabet very quickly.It is fun to use the typewriters because you can do so many things on them with the letters, numbers, and punctuation marks.Since I have come to school and used the typewriters I have been able to type a great deal more quickly and I am very glad that we have them in school to use.

Sincerely.

W----------

Ten Years

June 6,1930.

Dear Mr. M------,

We enjoy our typewriters a great deal. They make our papers look much neater and nicer. You can do your work more quickly also. For arithmetic there are figures,question marks,decimal points, fractions,and per cent signs. Our school paper the "B---------Weekly"looks so very nice that you are tempted to read it.Its typewritten sheets are easy to read and it looksneat. Typewriting also improves several marks on your report card. It improves "Begins work promptly" (who would not begin work promptly with a typewriter in front of him?)"Carries work to completion"and"Written English".

You can use typewriters for English, spelling,geography,homework,and almost any test.

Sincerely yours,

L----------

II years

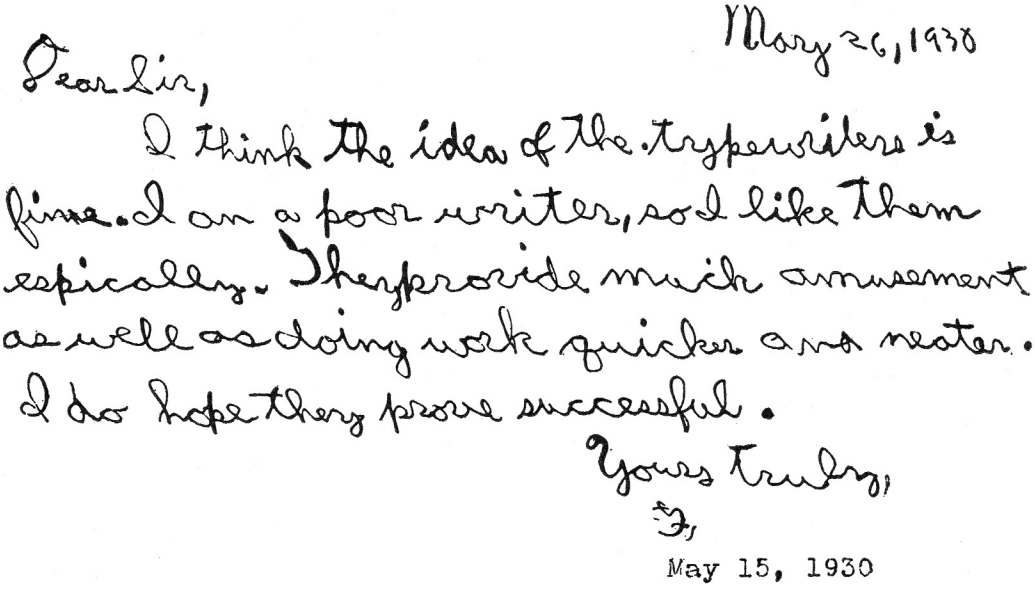
Grade six

FACSIMILES OF LETTERS WRITTEN BY TWO PUPILS IN GRADES FIVE AND SIX

Note the freely flowing character of the discourse.

The children in the upper grades mention the greater ease and speed of typewriting as a reason for liking the machines, but they also give considerable emphasis to the satisfaction they get from the "better work" made possible by the typewriters. Many of these children say they can "write faster and cover the subject better" on the typewriter than by hand. Several children say that the typewriter helps them to "concentrate on what they are writing about and think of more things to say about it."

Typewriting is enjoyable. The delightfulness of typing as a physical activity, associated with a colorful and interesting mechanism, is mentioned in nearly all the letters. Such expressions as "We have so much fun with the machines," "Typing is such fun," "I like to push the keys," "I like to double space," "I like to back space," "I like to write red" (using the red ribbon), "Typing is like a game," "Typewriting is like playing the piano," "I like to use my hands and fingers," "I like to hear



May 26, 1930

Dear Sir,

I think the idea of the typewriters is fine. I am a poor writer, so I like them espically. They provide much amusement as well as doing work quicker and neater. I do hope they prove successful.

Yours Truly,

E,

May 15, 1930

Dear M--------,

I am writing this letter to you by the touch system. I write faster by the touch system than I can when I am looking at the key-board.

I can write the alphabet by the touch system in 10 seconds. I write three times faster on the typwriter than I do by hand writing. I write twenty-seven words a minute on the typwriter by the touch system.

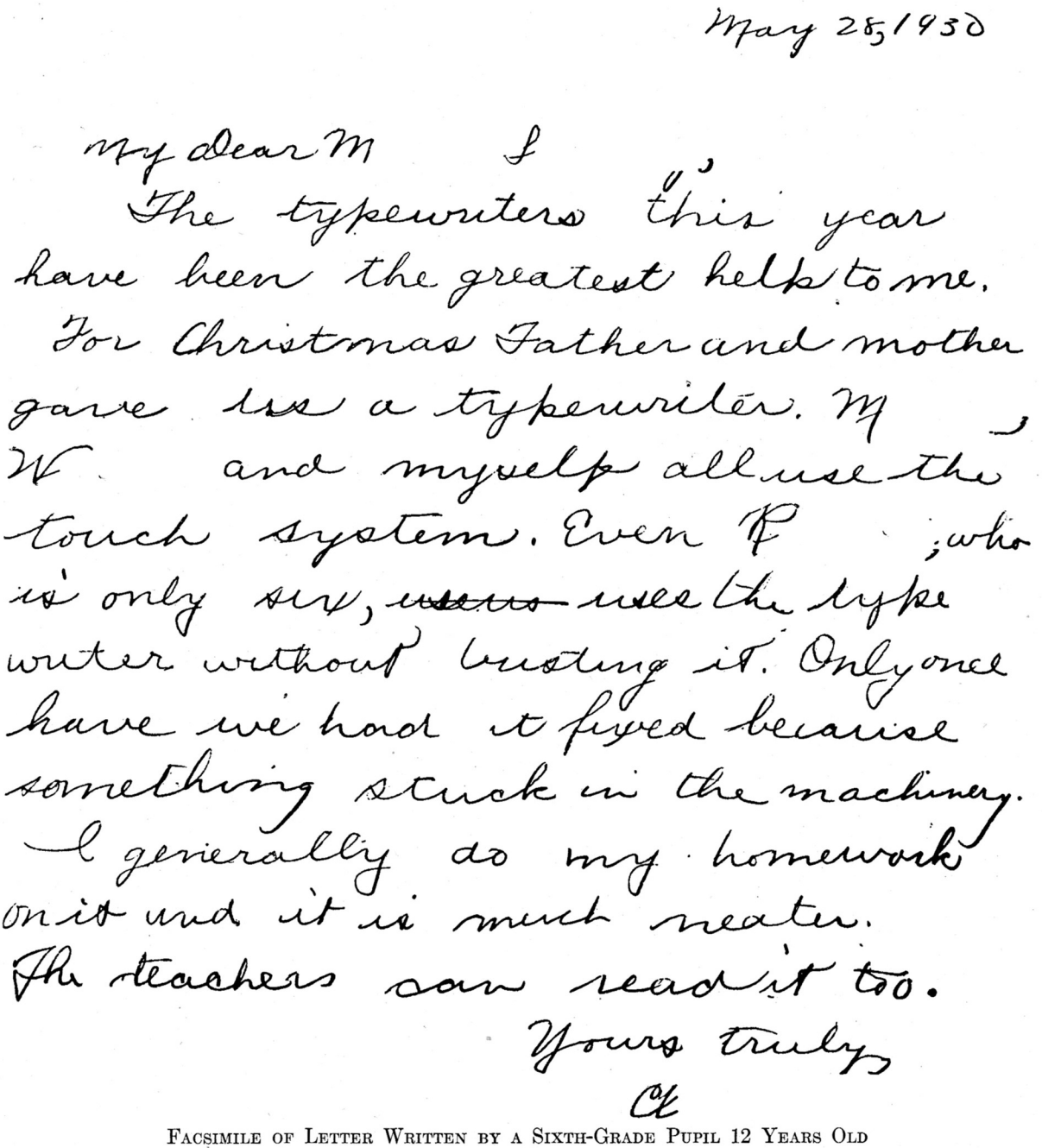
Yours truley

J----------

10 years old

FACSIMILES OF TWO LETTERS WRITTEN BY FIFTH- AND SIXTH-GRADE PUPILS NEARLY ELEVEN YEARS OLD

The handwritten letter was written by a pupil who is "a poor writer" with the pen, and who therefore likes the typewriters "especially." The other letter was typed by a fifth-grade pupil using the touch system, which probably accounts for his omission of "Mr." in the salutation to the Principal.



May 25, 1930

My dear M L

The typewriters this year have been the greatest help to me. For Christmas Father and mother gave us a typewriter. My W. and myself all use the touch system. Even F ; who is only six, uses the type writer without busting it. Only once have we had it fixed because something stuck in the machinery. I generally do my homework on it and it is much neater. The teachers can read it too.

Yours truly,

C L

FACSIMILE OF LETTER WRITTEN BY A SIXTH-GRADE PUPIL 12 YEARS OLD

The pupil shares a machine at home with her brothers and sister. All the children in this gifted family use the touch system, save the youngest one, who presumably uses the "hunt and peck" system, but without injuring the machine.

First Original

May 14, 1930

Dear Miss S-----

I am very glad to write you a letter and I hope you will like it. I am pretty sure that you are interested in what I think of the typewriters in our room so I will tell you about them in this letter. I like to type better than I like to write because it does not take so long. Some other reasons are that it does not take so much room, you don't have to worry about your writing although I like to keep up with my writing, if you want to make two copies of the same thing you can use carbon paper where in writing you would have to write it twice if you want it neat. When I first started to type I could write faster than I could type but now it is just the opposite.

The things I do on the typewrite are write letters, stories, copy poems, filling in blanks. We fill blanks in for Social Studies and science. We also do arithmetic and spelling on the typewriter.(The) I have never done any spelling onthe typewriter but the children who have done it like(to) it because they are always sure of having their i's dotted and their t's crossed. Miss F--------- taught us how to type on lined paper. She also taught us how to make exclamation marks. The way to make them is to press on the quotation key, then back space and put a period.

The colors on the typewriters are very pretty. They are orange, green,blueaand pink. We are allowed to talk at the typewriters when we are helping anybody.I often type book reports for our Library Club upstairs. When we made our Book Report Booklet I put a poem in for the front page and the second book report. I also typed a story for our tercentenary book. I am often chosen to type things for other teachers.

We often have language on the typewriters.We have typing tests in our room. We have four groups for typing. We sometimes type a half hour , sometimes less. The four groups are before school in the morning, arithmetic time, before school in the afternoon and reading time. When we have a new lesson we can not type in our typing period.

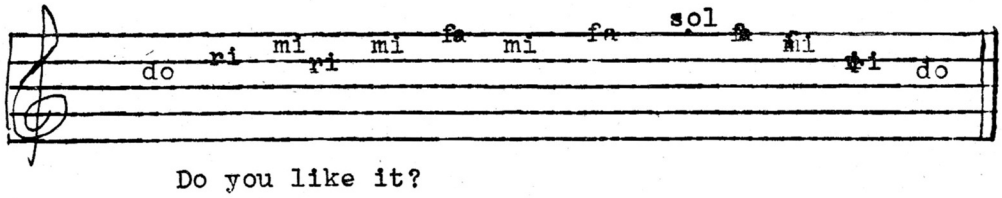
We type our newspaper on the typewriter. We make a red and black border. We type the rest of it in black. I often type an article for the paper. Sometimes we don't have a a turn at the typewriters but Miss F--------- tries to give ur a turn every day.

As long as I have told you the things I like about the typewriters I will tell you how we keep them. On one side of the roommwe have an office . We have moveble desksin our office. We keep the typewriters on these desks.Every night they are put away. Miss F---------showed us all how to put

the covers on. In the morning J--------- N------ comes in to dust. While she is in the room she takes the typewriters in. We have an office manager to take care of the office. If they children do anything wrong the manager reports them to the teacher. The things that we must not do are erase, ea t crackers when its crackers time.

Did you notice what we put up on the bulletin board this week? We are now making a booklet for the first grade. With the pictures you gave us we are mounting them. I think the first grade children will like the bbook. We hope so anyway.

This is the way to make a music staff.



Do you like it?

Well I think I had better closs now.

Your friend,
L----------
11 years old

FACSIMILE OF LETTER TO THE PRINCIPAL WRITTEN BY A SIXTH-GRADE PUPIL ELEVEN YEARS OLD

This letter is typical, both in content and form, of the longer letters written by pupils in the upper grades. This letter is the "First Original," composed at the machine. Note the reasons given by this child for liking the typewriter, and the educational implications of the various typewriting activities mentioned. This letter is well worth careful study, especially the third paragraph.

the bell ring," " I like the busy sound of the typewriters," " I like to have races on the typewriter," " I wish I could type all day," " The colors are so pretty," " The typewriters are so interesting," are found in almost all the letters, and indicate that the typewriters tend to increase the number and quality of pleasant associations with school work in the minds of the children.

Typing itself suggests interesting things to do, which are intrinsically valuable, but which are undertaken in the spirit of adventure and play. The presence on the keyboard of the numerals 1 to 10 leads the younger children to " play with " the numbers long before they have any formal instruction in number work, and leads the older children to experiment with all sorts of number patterns, which not only offers pleasant stimulation to a budding sense of form and design, but may also tend to clarify the pupils' insight into the simpler relations of the decimal system. A great majority of the letters from all grades mention this type of " play " with the numbers. The little tots say " numbers on the typewriter are such fun," and the older children say " the typewriter helps me do better arithmetic work."

The ease of typing straight lines of characters at various angles to each other, and the ease of placing characters on the page in regular and precise relations to one another, created the means for adventures in design and in " mechanical " drawing which the pupils discovered for themselves and seized

upon very soon after beginning the use of the typewriters. The letters of the younger children are filled with such statements as the following: "I like to make stars," "I like to make designs," "I make lots of soldiers with the typewriter," "I like to make houses with (the character) X," "We make pictures of boats with the typewriter," "We make lots of flowers and animals on the typewriter." Several children say the use of the red ribbon makes their flowers "look real" and their designs "prettier."

The older children refer to activities of this sort with more restraint and dignity. One boy "did a design on the typewriter" for the cover of a booklet which, he modestly admits, "the other boys said was nice." A girl "decorated" the border of the class newspaper, "using only the capital letter X." Several children in the sixth grade say they made "wonderful graphs that tell everything and look fine" for an arithmetic notebook. The older children do not "make" houses, boats, etc., on the typewriters, but they "draw pictures of" houses, boats, groups of buildings, towers, etc., "using only two or three letters on the typewriter." Many of these "machine" drawings have considerable artistic merit.

Children want typewriters. Several hundred of the letters express the hope that the children may have the machines in the classroom again the following year. "School is so much more interesting with the typewriters," "The typewriters help with everything," "We learn more with the typewriters," "The typewriters make all our work better," "We would miss them very much," are typical expressions in these letters. A considerable number of the children say they want a typewriter at home. A kindergartner says, "I wish Santa Claus would bring me a typewriter."

While no brief summary can give an adequate impression of the enthusiasm of the children for the classroom typewriter, it is hoped that the foregoing brief summary of the salient points in their letters will, with the aid of the accompanying facsimile reproductions of a few of the letters, convey some idea of the favorable attitude of the pupils and of the cogency and educational soundness of the reasons given by the children for their favorable attitude towards the classroom typewriters as used in this experiment.

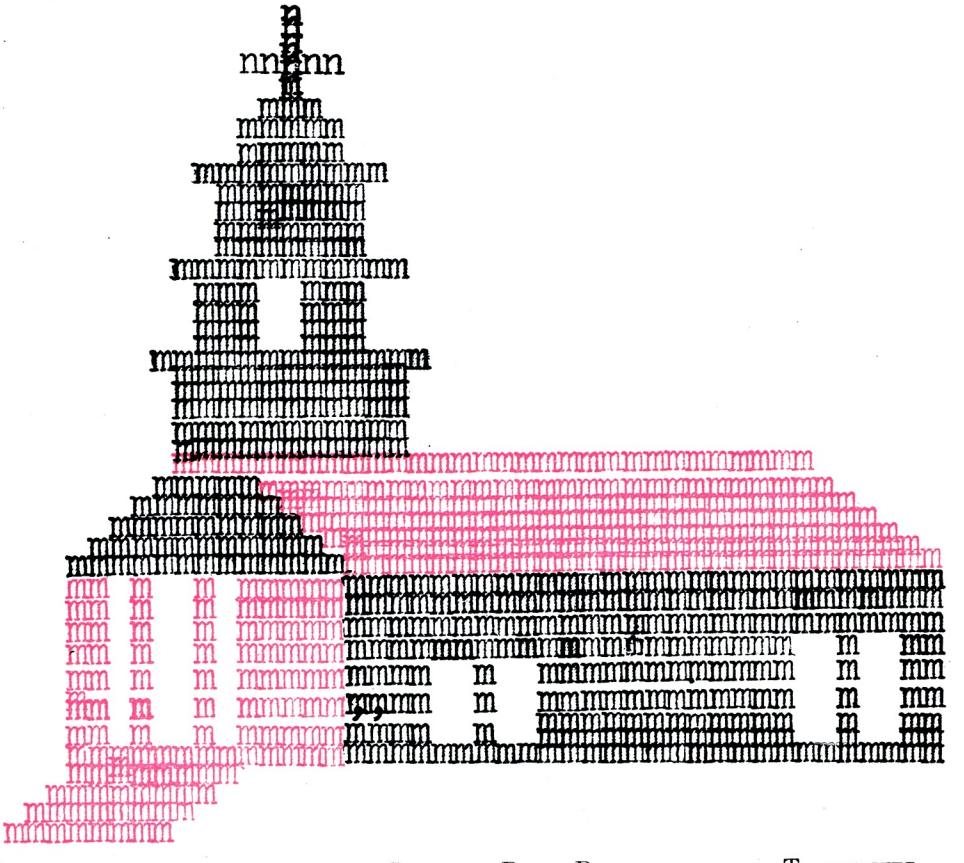


PLATE 6. FACSIMILE OF A DRAWING DONE DIRECTLY ON THE TYPEWRITER

This is the work of a fourth-grade pupil. His model was an old church in the community. The drawing is typical of many, representing ships, airplanes, buildings, etc.

CHAPTER X

EXPERIENCES OF INDIVIDUAL SCHOOLS

Introduction

In Chapters II and III was presented the evidence based on consolidated test data from six of the eight public school systems that participated in the experiment. In the present chapter will be presented brief summaries of the experience of the other two public schools (Cities G and H) and of the five private elementary schools that participated in the experiment. Tests were given in some of these schools, but the absence of comparable learning conditions makes meaningful test comparisons with the Control schools impossible; hence the following summaries will consist mainly of descriptions of the various ways in which the typewriters were used in each school, and of indications of the attitudes of the teachers and pupils toward the typewriters. These summaries are all the more interesting because they include indications of the attitudes of the principals and headmasters of the private schools, and of one of the public school superintendents. Some of these school officers are planning to publish more detailed reports of their experiences.

City G

The Experimental teachers in City G were among the most enthusiastic and active teachers in the experiment. Under the able leadership of the Superintendent and Principal, they initiated a number of very interesting local experiments with the typewriters which will be reported independently as soon as completed. These experiments, together with the curriculum differences between the Experimental and Control schools noted in Chapter I, made it unsafe to consolidate the test results with those from other cities, since the conditions were clearly not comparable.

The gains of the Experimental and Control groups were about the same, in both years, for the 200 Experimental and 300 Control children in grades one to six who had both initial and final tests.

The handwriting data of the Experimental and Control groups conform closely to the indications of Chapters II and III for the six cities; but the grade typing rates in City G are considerably higher than in the six cities. This is notably so in grades four to six, where the typing rate averages three words per minute greater than the Experimental or Control handwriting rates in each grade.

According to the judgments of the teachers, and our own observations, the influence of the classroom typewriter was at least as favorable in City G as in any other city in the experiment; but the absence of comparable conditions makes it difficult to interpret the test indications with exactness. Hence, pending the completion of the locally initiated experiments, we close the account of City G with the following excerpts from a report written by the Superintendent of Schools in consultation with the Principal of the Experimental school:

> There was no attempt made during the first year to teach children how to use the touch system. At the beginning of the second year, we decided to teach this system in the upper grades. About one-third of the pupils were new and had no previous experience with type-

writers. The speed and accuracy of all pupils were carefully tabulated, and it was found that pupils who used the machines for one year without any system were superior to the new pupils in the number of words written and also in accuracy. This lead they maintained throughout the year.

The teachers were unanimous in the opinion that every phase of school work was improved through the use of the machines. The desire to prepare all types of work on the typewriter brought children to school and kept them there whenever the use of the machines was granted to them. No child was told that he must use a typewriter, and no child failed to use a machine whenever one was available for him.

No unfavorable comments came from parents regarding the use of the machines and many expressed their approval. Several parents who moved to other parts of the city during the school year requested that their children be allowed to remain in this school so that they would not be compelled to discontinue the use of the typewriter.

Near the close of the year an exhibit of work including a demonstration of children actually using the machines brought much favorable comment and many inquiries regarding the possibility of wider use of machines in the schools. Although the typewriters were moved from room to room and were in almost constant use during the two-year period, their condition will compare very favorably with the machines used in the commercial department of the high school during the same period of time.

City H

As explained in Chapter I, so few of the children in the Experimental school had complete initial and final Gates and Stanford tests in the first year that the results from City H were not included in the six-city consolidation. For the same reason these tests were not given at the end of the second year. But the other test data from City H are in harmony with the corresponding test data presented in Chapters II and III. The very interesting questionnaire results from City H have been included in the analysis of teachers' judgments presented in Chapters VI, VII, and VIII. The typewritten work in several of the rooms in this school was unusually interesting and promising. This fact is reflected not only in the children's letters, several of which are reproduced in Chapter IX, but in the quantity and character of the children's writings.

While no exact analysis has been made of the children's writings in either year, a cursory comparison of the typed and handwritten papers is enough to show that the typewriter was used in practically all the kinds of writing done by hand, and in several ways in which handwriting would have been difficult if not impossible. Some of the projects, newspapers, labeling feats, and practice exercises done on the typewriter are hardly conceivable in terms of handwriting.

School I

The gains in this large private school were very large in both years of the experiment, the children in all grades averaging about 115 in intelligence quotient and from 0.5 to 0.8 of a grade above the norms of the Gates Reading and Stanford Achievement tests. The average gain in grades one to six from September 1929 to May 1930 was a little more than one whole grade; and from May 1930 to May 1931 about 1.4 grades. These gains are greatly in excess of the gains in one of the two schools that were selected as controls for School I, and about equal to the gains in the other one. The large differences between these three schools in average intelligence quotient, and the internal inconsistency of the test data from the second Control school, render meaningful comparisons difficult if not impossible. It seems clear, however, that the extensive use of the machines in this school was compatible with a slightly larger gain than that shown in Chart 3 for the 110–119 intelligence quotient groups in the six-city consolidation. (Cf. Chapters II and III.)

School I is the only school in the experiment in which the ratio of typewriters to

pupils in grades two to six inclusive was one to one. The unique contribution of this school is the indication, based on two years of experience, that a ratio of one to one is not only not necessary, but, in the opinion of several of the teachers, not desirable. This judgment is in harmony with the majority opinion of the two-year Experimental teachers as presented in Chapter VIII above.

The following paragraphs from a report written by the Headmaster of School I indicate some of the conditions under which the typewriters were used in this school.

During the years 1929–30 and 1930–31 the typewriters have been used in the kindergarten and in grades one to six. There were five machines for the 35 pupils in kindergarten, fifteen machines for the 50 pupils in grade one, and one typewriter for each pupil in grades two to six.

In the kindergarten the machines were introduced to the pupils as any other part of the equipment. They were there to be used by the pupils, with a minimum of assistance from the teacher. In grade one the pupils received informal instruction in groups of four or five in the fundamentals of operating the machines. The machines were used chiefly in the period for freely chosen activities. In grade two much more instruction was given in the various operations involved in using the machines.

At the beginning of the first year an expert typist visited the fourth-grade class and explained the typewriter operations with such satisfactory results that we have adopted the plan of having similar visits at the beginning of each year in grades five and six also.

Below grade two the typewriters have been used as one of several means of expression, almost always on the initiative of the children. This means that some children use the typewriter frequently and some almost never. Some children never get past the stage of manipulating the machine for fun. Not many could write much directly because of their lack of knowledge of spelling. Most of the children copied sentences or stories from books or from stories dictated to the teacher. One of the teachers says that very often every one of the typewriters was in use in grade one during the whole work period. Some asked for different work to do — sentences to copy, names to write, etc.

In grade two carefully planned work, sometimes more or less formal, was done, but the individual child was free to use the machines. They were used chiefly on the initiative of the children for special work.

In the third grade one teacher who has been in the school for two years has left, and the other has not been particularly interested in the use of the machines.

In grade four and above they have been used frequently on the initiative of the children, regularly by a few. Occasionally drills have been given for proper shifting, use of two hands, etc., but most of the work has been individual recording, note-book copying, etc. About half of the class used the machines regularly for spelling.

In grades five and six there has been little actually planned work, except in the fifth-grade English, where all of the work in composition was done on the typewriters, and also the greater part of the written work in weekly Bible Study. Frequently the machines were used in preference to longhand.

In October 1931 the Headmaster made an independent study of the judgments of his teachers on the classroom use of the typewriters. The following excerpts, quoted from his report, are in general agreement with the analysis of teachers' judgments reported above in Chapters VI and VII.

A. Reading. In grade one the children became interested in words after using the typewriter and are greatly helped in capitals, in words that have double letters, etc. The work makes for accuracy, but has a tendency to slow up the reading for a time. The children get clearer word pictures, however, in learning to read. One teacher writes: "Undoubtedly the use of the typewriters has had an advantageous effect on the children's reading. Primarily, it creates a desire to read on the part of first-grade children. It also increased accuracy and facility. Rapidity is noted more in learning to read than in speed in reading."

In the second grade a very decided effect is noted in accuracy, rapidity, and facility in reading, but of course those who read best are usually the most rapid typists. The typewriter has provided additional opportunity for very informal, spontaneous reading. In grades four to six the use of the typewriter has aided very much in reading of each other's work.

B. Number Work. The children are much interested in writing numbers on the typewriter before using pencil in this work. When it comes to the use of the pencil, they are more apt to

be accurate. The aid is in identification and forming numbers. A first-grade teacher writes: "Almost nothing is done in the first grade, in the way of arithmetic, with the typewriters. The children love to type the figures. In this way they get a perfect picture of figures and learn to recognize them more quickly."

The teachers of the second grade feel there is practically no effect on arithmetic work, since the machine is too complicated in arithmetic work to be used by second-grade children. A few children who were inclined to write their numbers backward have been helped by the use of the typewriter. In grades four to six no appreciable effect seems to be noticeable in arithmetic. In computation a few of the children who are careless, or who lack motor coördination, are helped in setting down figures but this slows up the work. In some cases accuracy has been acquired by insisting on typewritten work by careless children. The neatness of papers is an incentive to a number to use the typewriter

C. Language Usage. The youngest children learn the use of capitals more easily through the typewriter and are much more easily interested in punctuation marks and the finished product is clearer than in handwork. This benefit is more pronounced in the second grade. The need for punctuation is made apparent and we find punctuation better than ever before. "Spelling is wonderfully improved," says one teacher. The hunting out and typing a letter makes more impression on the young mind than tracing out penciled forms. Experimentation with the typewriter with punctuation, spelling, etc., makes the children much more interested. In grade four and above, the typewriter has been reported to have been some aid in spelling, in the form and arrangement of written composition, and to have aided very materially in punctuation. The teacher chiefly responsible for English in the Intermediate School reports that it has been a help in spelling, punctuation, and in general language usage. It has helped many poor spellers. The punctuation marks on the typewriter are reported to have a fascination for children.

D. Quantity and Quality of Work. In the amount of writing done, freedom of expression, general quality, appearance and satisfaction in written work, and the length of papers handed in, there is a general unanimity that the typewriter has been a decided help all along the line. In grade one there is greater satisfaction in writing stories on the typewriter than by hand. The original stories written by first-grade children, toward the end of the year, were longer and clearer than handwritten ones. A first-grade teacher writes: "The typewriters have been used by the children for original story writing and in copying stories. They are much desired for this purpose, and have been a great help in completing a story before the enthusiasm for composing it has waned."

In grade two there is noted a marked improvement in freedom of expression and general quality, since little hands and small muscles can better cope with a machine than with a pencil. Pleasure and satisfaction were shown in the clear-cut work of a machine. The length of handwritten papers was noticeably less than was the case in typewritten papers. The use of the typewriter in composition work in grade two has stimulated vocabulary growth. In the free activities period several children used the typewriter frequently and asked how to spell many new words. In grade three all freely initiated work reported was done with pencil and the report is negative on length and interest in composition work. In grade four there seems to be no difference in the length of papers, but the children are glad to have another medium of writing to relieve the monotony of routine lessons. One fourth-grade teacher notes the pleasure and satisfaction in the producing of good-looking papers by the machine and says that longer projects were generally planned and accomplished. Individual pupils have better muscular control, and showed a marked degree of enjoyment in producing work on the machine that otherwise would have been labored. In grades five and six similar effects have been noted but they are much less pronounced.

E. Handwriting. In handwriting, where manuscript writing was used in the early grades, the forms of the letters were made more clear in the initial stages, because of their similarity to the printed form. One first-grade teacher reports that the use of the typewriters has not materially affected the rate of the handwriting nor has it lessened the interest. It does produce a better quality in writing generally. In grade two handwriting is speeded up because of a better understanding of printed matter and a better power to reproduce in spelling and composition, but no difference in quality is noted. Lack of facility in writing in grade one did not slow work up because the children could use the typewriter in their free time. In grade four the reports of the teachers are not in unison — one teacher feels that the rate was somewhat slowed up and that with some children the interest in handwriting declined slightly, while another teacher reports improvement in quality, rate, and interest in handwriting. In the upper grades no special effect on handwriting is noted, but the

class that has advanced from the fourth to the fifth grade since the typewriters were started, contains an unusual number of good writers. It is difficult, however, to state whether this is due to the use of the typewriter or not. The teacher of writing who has been connected with the school for many years, an unusually experienced and skillful teacher, presents the following report which is all in favor of the typewriter:

"In the majority of cases throughout the school I feel the typewriter has been very beneficial. It has helped in the neatness and arrangement of the page. The primary classes have lost nothing in penmanship by its use except a few cases of confusion in letter forms of the print and the manuscript. After clearing this up in the minds of those confused there seemed to be no further hindrance. In the upper grades there were individual cases where, had handwriting had more practice in English, etc., I feel the writing now would be better, while in other cases, hastily scribbled pages gave way to neatly typed work. The interest in handwriting is still keen and a greater per cent are receiving the coveted certificate granted by the Zaner School of Penmanship. So, all in all, the typewriter has a decided place in our educational institutions, in my estimation."

The teachers were asked whether they wished the typewriters or a considerable number of them to be retained as a part of the teaching equipment of the school. In the kindergarten there is no strong feeling on the subject, but they are recorded as an interesting and stimulating mechanical device for children to use, if they wish. Above the kindergarten, however, with the exception of one third-grade teacher, there is a strong and unanimous desire for the continuance of typewriters as part of the regular classroom equipment.

One first-grade teacher says: "I found them a means of expression the children learn in a very natural way, asking questions and investigating for themselves. The typewriter was a very good means of arousing interest in written language." Another first-grade teacher reports as a valuable element the chance to progress steadily as the year goes on and dwells on the satisfaction of the children in early language work from the use of the machines. One of the second-grade teachers thinks individual machines are not desirable, but would like a few. The other teacher wants a machine for each child.

A new third-grade teacher who has entered the school this year says that she is amazed at the ease with which her children and other children of the school express themselves. "I can see that the typewriter may play an important part in this. At least the volume of written and oral expression is greater than that of the schools I have had contact with where there were no typewriters."

On the other hand, the other teacher of the third grade reports as follows: "I do not wish to have the typewriters retained in my room. Reasons: Our school day is too short to include all the benefits to children of manipulative activities, self-expression, planning, and judging work, etc. I think typewriter teaching should be sacrificed before these universally accepted phases of teaching, for which time is now too short." She says, however, that a few typewriters would be of value in the room if there were time to teach their use. She concludes: "In general I do not think the value of the typewriter is sufficient in third grade to warrant the amount of drill necessary to acquire a convenient speed."

The fourth-, fifth-, and sixth-grade teachers all wish to have the typewriters retained. Among positive gains mentioned are the fact that they are an additional tool of expression, because typewritten labels, etc. are more easily read by the children, because they aid in the form of written work, straight margins, spacing on paper, etc., because they are a great incentive in fifth grade where writing is apt to be laborious, especially for boys, and where ability to work and imagination outstrip mechanical ability to write with the pen.

One teacher of the upper grades reports many typewriters used in the home as well as in school, and states: "I hope to have home work done on the typewriter more and more, since I believe it helps in spelling, punctuation, and general neatness, and that it counts in all grades of school. The typewriter habit is an excellent one to encourage."

Schools K and L

In School K only 63 pupils in grades one to six had both initial and final Gates and Stanford tests in the first year, and still fewer in the second year. As noted in Chapter I, the school selected as a Control for School K was found to be so different in several major learning conditions as to make meaningful test comparisons impossible. In School L no tests were given in either year of the experiment. The main purpose of including these schools in the experiment was to study the adaptability

of the classroom typewriter to a variety of school and administrative situations. The testimony of both teachers and administrators in these schools is in harmony with the evidence presented in Chapters VI, VII, and VIII. Hence details are omitted, since their inclusion here would be needlessly repetitious.

School J

School J is one of the private schools in which no tests were given, the main purpose being that of trying out various ways of using the typewriters at each grade level, and carefully observing the results. There were 405 pupils and 170 machines in the elementary division. These were assigned in varying numbers to seventeen rooms. In some rooms there was one machine for each pupil, and in others only one for each ten children.

The observations of the teachers and supervisors are in agreement with the indications of the preceding chapters, and hence the giving of details here would constitute needless repetition. The following excerpts from a report furnished by the Principal indicate some of the more important ways in which the machines were used, and the general nature of the results obtained, which led to the installation of the machines as a part of the regular equipment of the school.

At the beginning of the first year the machines were introduced to the children by the individual teachers. These teachers were not trained in the use of the typewriter, but were given instruction in the mechanical manipulation by a member of the school's stenographic staff. The details of this mechanical manipulation were taught to the children by the teachers.

In some classes the use of the new machines was made the theme of a short unit of work or project. The children discussed their usefulness with the teacher; they formulated lists of ways in which the machines could be used; they assembled questions concerning the things they wanted to know about them, and then invited a member of the stenographic staff to join their class discussion, and, as an "expert," answer the questions which they had compiled.

The care of the machines was a new problem for the children which was handled in different ways in different rooms. The reasons why special care was necessary were discussed; the time for using the machines, the conditions under which they could be used, the care of them when not in use, — all these matters became a part of the education and activity of the children.

Committees responsible for this new "common property" were elected. Various methods of distributing and collecting them after use were discussed. Respect for the machine and care in its use by individual children were brought about in various ways — always with an emphasis on the fact that the typewriters belonged to the whole group and that the individual who misused them was injuring something which belonged to them all. It is interesting here to note that the emphasis placed upon this group ownership, and the care which the group insisted upon from its members, have brought the machines through nearly three years of hard usage with practically no breakage and a minimum of injury.

As an example of this group activity in caring for the typewriters, it may be interesting to present in the very form in which it was produced a "Set of Rules" for the use of the typewriters as developed in a class meeting in a fourth grade room. (See page 175.)

The interest of the children in the machines did not wear off; on the contrary, it increased steadily because the children were continually finding new ways in which the machines could be used, and the growing satisfaction which they experienced developed an interest which was not as ostentatious as the first excitement, but was more real and steady, manifesting itself in visibly greater persistence, greater independence and self-reliance, and more self-initiated projects carried to completion.

By the end of the first year the typewriters were accepted as essential by teachers and children, as the following extracts from teachers' reports to me will show:

> "The typewriter stimulates an interest in spelling and reading, and affords an excellent opportunity for self-drill on these subjects. Teaches children the control and care of an ever useful machine. The children have all used the typewriters freely and the typewriters are at the end of the year in excellent condition." *A First Grade Teacher*

> "Unquestionably, the children enjoy the typewriters immensely. They find unlimited

Typewriting Rules

ϕ. Don't choose any special typewriter but take the one that comes.

2. Don't play with the ribbon reverse.

3. Don't damage the typewriters.

4. Don't play with your typewriter.

5. Don't press down all the keys at once.

6. Have your typewriter away by a quarter of one.

7. Don't bother anyone eleses typewriter.

8. Don't let your typewriter drop.

If you disobey any of these rules youwwill have you name taken down.

If you have your name taken down five times you can not use a typewriterffor a week.

FACSIMILE OF RULES ADOPTED BY A FOURTH-GRADE EXPERIMENTAL CLASS IN SCHOOL J

These rules were typed by the pupil who had been elected Chairman of the Typewriter Committee by the members of the class.

possibilities for their use. Many things are copied on the typewriters which would not be copied otherwise. The children take great pride in neat typing and good arrangement. Incidentally, there are being formed habits of 'doing something about' a favorite poem or story. The children want to use the machine, so they find something for which to use it." *A Second Grade Teacher*

"The five typewriters in my room are in constant use during the afternoon study hour and in English periods when it is feasible. Practically every child uses the typewriters. At least eight can write fairly rapidly and can produce good-looking papers. Some of the pupils use only two fingers, some use four. One girl is trying to learn the touch system." *A Sixth Grade Teacher*

In the second year the use of the machines was more definitely planned. A supervisor of typewriting and handwriting was made available to the teachers. Certain experiments were set on foot and various ways of using the machine and teaching its use to children were inaugurated. Typical illustrations of these experiments will suffice in this necessarily brief report.

In a second grade, under the direction of a teacher who was trained in typing, the children were given regular lessons on the machines. Each child had his own machine; the me-

chanical operations were carefully taught; the children learned the keyboard; they learned the use of both hands, and a modified "touch system" was introduced. The children learned quickly and by the end of the year had gained considerable speed and proficiency. It was a common thing to see this group of seven-year-olds doing their spelling on the machines as dictated by the teacher.

A controlled experiment carried on in two second, two third, and two fourth grades to determine the effect of typewriting upon manuscript writing produced the evidence that typewriting does not affect handwriting for good or ill.

A preliminary experiment was set up at the end of the second year and will be carried out in detail during the coming year. The purpose of this experiment is to study the detailed effects of the use of typewriters on reading in the very early stages.

There is no question as to the value of the portable typewriter in elementary education. In the opinion of skilled teachers, it presents an excellent introduction to written words, presenting to the child an instrument for reproducing letters and words as they appear to him in his books; it offers him a vehicle for easily expressing his thoughts and increases the amount of his contact with words through writing. It encourages the writing of longer and more sustained compositions; it develops a sense of neatness and a feeling for form and orderliness. It appeals to the child and challenges his interest; its mechanical manipulation is easily mastered and with a little teaching and practice the average child gains speed and accuracy rapidly.

A very large number of parents, after seeing how their children used the machines in school, purchased portable typewriters for their children's use at home.

On the basis of the teachers' opinion and the progress made by children in the school, we have begun the installation of our own portable typewriters as a regular part of the school's equipment.

School M

In School M the experimental work was organized in three units: the first was carried out in 1929–30, and consisted of a very informal trial of the typewriters with high school pupils; the second was in grades one, two, and three and was continued throughout 1929–30 and 1930–31, and is now going forward for another year; the third was inaugurated in October 1930 in grades four, five, and six, and is now being continued, with modifications, through 1931–32.

The high school unit. The high school pupils were offered the opportunity to make use of the typewriters during their study hours without definite instruction and without receiving credit for their work. Typewriters were placed in a vacant room and the supervisor of the experiment initiated the students into the use of the machines. A proctor was present when the children were using the machines, but very little instruction in typing was given. The experiment was carried on through one year. Eighty-four students used the typewriters throughout the entire year, fifty in addition used it for the first semester, and ten for the second semester. Under the circumstances this indicates a rather vigorous demand for the opportunity to learn to use the typewriter.

At the end of each period of using the machine, each pupil filled out a card telling the kind of work done at the machine, the length of the work, and how much time he spent in producing it. The list of the types of work which were turned in by the students indicates a great variety of uses to which the typewriters were put. Fifty-six types of work were listed. Twenty-one of these were represented by ten or more cards. By far the largest amount of time was devoted to exercises and practice. This emphasis upon more or less formal work was not imposed upon the pupils, but was the result of the fact that they felt the need of such practice. This suggests that at the high school level, at least, a reasonable amount of more or less formal practice is not repugnant to the pupils. With the exception of practice and the use of exercises, the work consisted of the preparation of reports, papers, and class

material in connection with the various courses which the students were taking. The average time represented in each piece of work was about fifty minutes and the average number of pages about one and three-quarters.

This experiment seems to indicate that there is a very definite demand for the opportunity to use the typewriter in the high school, and if this opportunity is furnished, the pupils will take ample advantage of it.

The primary grade unit. This unit of the experiment was carried out in much the same way as in the primary grades in other Experimental schools, except that no effort was made to measure gains by means of initial and final tests, the whole emphasis being on observing the adaptability of the machines to the primary grade situation in a laboratory school. The judgments of the teachers and school officers are in harmony with those presented above in Chapters VI and VII, hence their inclusion here would be a needless repetition.

The intermediate grade unit. The purpose and results of this unit of the experiment are indicated by the following report written by the Principal of the school, under whose immediate direction the experiment was carried out.

The third unit of the experiment was conducted in grades four, five, and six in 1930–31. The specific purpose was to find the kinds and extent of help the use of typewriters affords to children of these grades in spelling, written composition, and reading. For the purposes of the experiment paired sections in each grade were organized on the basis of sex, mental age, intelligence quotient, ability in spelling as measured by standardized tests, ability in reading as measured by standardized tests, general ability in composition according to teachers' rating of papers, and the complex of abilities contributing to success in school according to teachers' judgments. With the exception that the Control groups used pen and pencil and the Experimental groups used typewriters, the teaching and practice procedures in the groups were fundamentally alike. Time allotments, study materials, and teaching methods were alike. Outcomes were measured from time to time by standardized and unstandardized tests.

The outcomes as measured by these tests and as indicated by a study of compositions were negative in the sense that they failed to show an advantage gained by the use of typewriters or by the use of pen and pencil. Both the Control groups and the Experimental groups made progress, probably greater progress than corresponding grades had made in earlier years. Competition was an unfortunate but unavoidable element.

Test scores cannot show all the outcomes of such an experiment. Even when such scores are supplemented by statistical data about growth of the mechanical elements of composition, the story is incomplete. There is failure to take into account children's expanding speaking and writing vocabularies, their proficiency in attacking new spelling problems, their growing consciousness of the significance of sentence structure, and their increasing skill in expressing thought directly and adequately. It is in growth of these kinds that we think we see an advantage gained by the children in the Typewriter groups. The typewriters seemed to be a less distracting medium of expression than pen and pencil. The pupils seemed more free in their choice of words, more willing to use new words, more conscious of the relation of parts of the sentence to each other, not in the sense of analysis but in meaning, and more spontaneous, more direct, and more forceful in their composition.

These observations are not scientific; they ought to be checked by a refined technique of testing. We hope to be able to improve our technique this year. Whether or not we use paired groups, we hope to be able to present some data which may be considered as objective evidence.

The Typewriters in a Convalescent Home for Children

The use of the typewriters by children in sight-saving and other special classes has been mentioned in Chapter V, and elsewhere in this report. During the spring and summer of 1931 some of the typewriters used in School M were made available to the children in an orthopedic hospital and in a convalescent home that were under the same institutional auspices as School M. It seems fitting to close this chapter with a

brief summary of this interesting use of the typewriters by handicapped children.

In the hospital the circumstances made the use of the typewriter difficult and of limited value. All the teaching in the hospital had to be carried on by the method of individual tutoring. A disproportionate amount of time was, therefore, required to initiate the children into the use of the machine. The rapid turn-over made it necessary to spend most of the time in initial practice. Furthermore, the distribution and collection of the machines was awkward. For these reasons the number of machines in the hospital was reduced to two, and these were furnished only to children who could take advantage of them.

In the convalescent home the situation is quite different. The children are residents in the home for a period of weeks or months, and sometimes years. It is, therefore, worthwhile to devote sufficient time to enable them to learn the use of the machine. The following paragraphs describe the use of the typewriters in the words of the principal of the school in the convalescent home:

In the classroom the children used the typewriters, under the direction of the teacher, for language work and for home letters. The language work has increased in neatness and accuracy with the use of the typewriters, and the home letters have shown improvement in mechanical make-up and in subject matter.

Last spring we used the typewriters for spelling, with results which seemed to justify the use of the typewriters. We cannot say definitely that the use of the typewriter increased efficiency in spelling, since many other factors affected the May and June results in spelling; but the use of typewriters created greater interest in spelling, and the best results of the year were obtained after the typewriters were introduced. (The use of typewriters in the spelling class has been discontinued this year because the spelling periods have been reduced in length.)

In addition to the directed use of the typewriters, the children are permitted to use them for projects of their own, such as copying poems, labeling collections, and writing up minutes of club meetings.

A survey of the benefits the children have received from using typewriters indicates that the children have developed considerable mechanical dexterity; that they have become more conscious of the use of punctuation, paragraphing, and margins in all written work; that the increased interest in tasks to be done has brought about more efficient work; that in spelling work, the children are probably more conscious of the individual letters which make up a word than before using typewriters.

CHAPTER XI

SUMMARY

A CONSIDERATION of the question of whether typewriters should be introduced into the schools immediately suggests two possible values of the use of the typewriter. The first is the obvious value to the individual of the possession of skill in using the typewriter as an asset in later life. Already many adults possess typewriters for their private use in correspondence, in authorship, and in various other professional activities. Many students in the high school, the college, and the university use the typewriter for the preparation of much of their written work. That the possession of skill with the typewriter will be of use to a large and increasing number of individuals after they leave the elementary school may be taken as obvious and not needing special demonstration. Such value must be added to those values which were made the special subject of investigation in this study.

Writing is a skill which is employed not only in the practical activities of adult life, but also as an instrument in the processes of learning in the school. The child not only learns to write in the school, but he uses writing as a means of working out and recording his thoughts and in carrying out many of the activities required in the school. If the typewriter is introduced into the school, it will also serve, along with handwriting, as an instrument in the performance of school activities. The question which confronts us in evaluating the typewriter in the school, then, is whether the addition of typewriting to the usual mode of written expression will facilitate the educational operations in the school. To put the matter simply, the question is whether the addition of the typewriter to the child's other modes of expression will enable him better to learn English, spelling, arithmetic, geography, history, etc., and to develop those attitudes and habits which constitute so important a part of the aims of elementary school education.

If the use of the typewriter possesses this value, in addition to its obvious and direct value, strong support will be given to the introduction of the typewriter into the elementary school. In fact, the chief reason for using the typewriter in the lower grades will have to be found in its educational influences rather than in its vocational or direct utility values. The present investigation has shown that the child in the elementary school can acquire in the course of one year as much typing speed as he is likely to acquire in two years through informal practice of the sort enjoyed in this experiment. The demand of later use, therefore, could be met by the introduction of the typewriter for one year toward the end of the elementary school period or in the junior or senior high school. If, however, the use of the typewriter in the lower grades makes the learning of the other subjects more effective, and promotes desirable attitudes and habits, the introduction of the typewriter into these grades can be justified.

The primary purpose of this investigation, then, was to compare the progress, in the various subjects of instruction in the elementary school, of children to whom the classroom typewriters were available with the progress of a control group of children

who had no opportunity to use the typewriter in the classroom. The measurements of the attainments of the Experimental group and of the Control group consisted, first, in the results of the Gates Reading Test (Types 1, 2, and 3) in grades one and two, of the Stanford Achievement Test in grades three to six, inclusive, of the Ayres Handwriting Scale for quality and rate, and of specially constructed tests of typing speed and typing accuracy. Supplementing these tests of attainment, a measure was taken of the amount of writing done by the children, both in the form of handwriting and of typewriting. In addition to these quantitative measures of the children's attainments, judgments were secured from the teachers and from the children themselves regarding the value of the typewriter, and an expression of their attitude toward the typewriter and its use in the school was obtained.

It is not necessary at this point to review in detail the conditions of the experiment or the experimental procedure. The usual steps were taken in planning and carrying out the experiment to secure results of statistical reliability. Care was taken to secure an adequate number of children and of teachers, and to obtain comparable groups of children from the point of view of age, intelligence, educational background, etc., to secure groups following the same curriculum and taught by equally competent teachers, and to keep the entire teaching procedure constant with the exception of the use of the classroom typewriter. The effort to keep the Experimental and Control groups comparable in all these respects succeeded in the main, and such slight variations as were found to exist were taken account of, and such qualifications as were necessary in the light of these variations were made in drawing the conclusions. The experiment ran through two years and the results of the first and second year are treated separately.

Brief Summary of Results

Comparative educational gains. The general educational advancement and the advancement in reading were measured by the Stanford Achievement Test and the Gates Reading Test. The first test comparisons between the Experimental and Control groups were made in terms of the gain during the first year from September 1929 to May 1930. The Experimental gain exceeded the Control gain in four of the six grades, the unweighted average of the gross excess gains of the Experimental groups in the six grades being seven per cent of a grade for the first year. The difference in favor of the Experimental group in the four grades in which this group was superior varied from two to five times the probable error. The average critical ratio for all six grades was about three.

This evidence means that it is fairly certain that the Experimental group made more progress than the Control group in the types of educational achievement measured by the tests used. Part of this superiority is to be attributed to the superiority of the Experimental teachers, as indicated by the supervisors' ratings. The partial correlation studies indicate that the excess gains on the Gates Reading Test of the Experimental groups in grades one and two are probably attributable in large part to the superiority of the Experimental teachers. This indication of a negligible typewriter influence on the kind of achievement or ability measured by the Gates Reading Test does not support the judgment of the Experimental teachers that the typewriters were especially helpful to the children in these two grades and in kindergarten. On the other hand, the indication does not necessarily contradict the judgment of the

teachers or the evidence derived from the pupils' writing, or the testimony of the pupils themselves. It is quite possible that if other tests in the lower grades had been feasible and within our resources, the test indications would have been as favorable as in the upper grades. But it seems clear that, however valuable may have been the contributions of the typewriters in grades one and two, they are not reflected in the results of the Gates Reading Test.

In grades three to six, however, the partial correlation studies indicate that the influence of the classroom typewriter on total Stanford Achievement Test gains was positive, but small, its potency being approximately equal to, or at most only slightly greater than, that of the superior ability of the Experimental teachers as indicated by their supervisors' ratings. This indication, that the typewriter has a positive influence, however small, on gains in the type of educational achievement measured by the total Stanford Achievement Test, is of considerable importance.

The interpretation of the test indications for the second year is somewhat involved. According to the best interpretation we can make of the results the Experimental group continues to be superior to the Control group approximately to the same extent as in the first year.

Comparative subject matter gains. When the Experimental and Control gains in the individual subjects in grades three to six are compared, it appears that the superiority of the Experimental group was greater in some subjects than in others. Considering the probable errors, the most significant differences in gains in favor of the Experimental groups were in the following sub-tests, in order: spelling, arithmetic computation, geography, word meaning, language usage, and paragraph meaning. The critical ratio for paragraph reading is only about 1.13, but for the other sub-tests just mentioned the critical ratios range from over 2.5 to nearly 6. The partial correlation studies indicate that the influence of the typewriters on gains in spelling was measurably greater than that of the teachers' ability according to supervisors' ratings. The typewriter and teacher influences on gains in geography, word meaning, language usage, paragraph meaning, and arithmetic computation were small and approximately equal; both typewriter and teachers' rating influences on first-year gains in the other sub-tests were negligible according to the partial correlation indications.

At the end of the second year the subjects in which the Experimental group made the greatest excess gains were not the same as at the end of the first year. This variation between the results for the two years, together with the fact that it does not seem possible to explain from the nature of the subjects why the Experimental group made superior gains in the particular subjects in which these gains were made, make it seem probable that the differences between the subjects are due, at least in part, to more or less accidental circumstances. The teachers apparently found more opportunity to use the typewriter in connection with some subjects than with others. This greater quantity of practice apparently helped to produce the excess gains in these subjects. Taking the test results of both years, together with the other available evidence, it seems reasonable to conclude that the typewriter can be used advantageously in most, if not all, of the subjects of instruction in the elementary school. There is fairly consistent evidence that the typewriter's influence on spelling is more favorable than on any other subject tested in the Stanford Achievement Test. If the classroom typewriter has inherently special adaptability to any other of the subjects

connoted by the ten Stanford sub-tests, such special adaptability must be established by further research.

Handwriting quality and rate. In view of the fact that the Experimental group produced somewhat less handwritten material than did the Control group in the grades beyond the second, due to the circumstance that part of the time ordinarily devoted to writing was spent in typewriting, the question naturally arises whether the handwriting suffered. A careful and detailed analysis of the speed and the quality of the writing of the two groups failed to yield any evidence that the handwriting of the Experimental group was any the poorer on account of the use of the typewriter. The skill gained in the use of the typewriter, then, was clear profit and was not made at the expense of skill in handwriting.

Typing speed and accuracy. The skill in the use of the typewriter which was obtained by the children of the Experimental group was very significant, considering the relatively small amount of time which was spent in using the machines. In one year the children learned to write approximately as fast on the typewriter as with the pen. The accuracy which they attained was also encouraging, considering their childish limitations and the informal character of their practice. The average typing error ranged from three to six per cent. The speed obtained during the second year advanced little beyond that of the first year, except for the gain which corresponds with maturity. With informal practice and for children in the elementary school, there apparently exists a " natural " or grade typing speed limit which corresponds roughly to the speed of handwriting. To obtain advance in typing speed beyond the speed of handwriting we must apparently either wait for greater maturity or institute more formal and intensive typing practice than was used in this experiment.

Writing productivity. One of the highly significant findings of the experiment is that the use of the typewriter apparently stimulated the children to a greatly increased output of written material. This finding seems significant because the evidence indicates that quantity of writing is positively correlated with gains on the Gates and Stanford tests. The increase in output was particularly significant in the case of original material, as distinguished from copied material or practice exercises. The excess was especially large in the lower grades in both total output and output of original material. This fact is considered especially significant because it is in the early stages of school work that the disadvantages and limitations of handwriting as a means of written expression have been most often observed.

Another indication that the typewriter apparently stimulated the pupils to fluency in writing is the fact that the individual pieces were on the average longer in the case of the Experimental group than in the case of the Control group. One might suppose that the use of an unfamiliar instrument of expression would reduce the output of written material or the length of the pieces. That the opposite is the case may be attributed to the pleasure which the children took in using the typewriter, to the comparative ease with which they manipulated it, and to the satisfaction which they took in the appearance of their papers, or to all of these and other factors.

In any case, the stimulation of written expression, since it did not involve any sacrifice in other forms of achievement, must be taken as a significant educational gain. It is especially interesting that the typewriter does not seriously compete with handwritten productivity. On the contrary, it seems to have increased hand-

written output in the lower grades. In the upper grades the Experimental handwritten output is smaller than the Control, but the decrease in handwritten output in these grades does not seem to be large enough, in relation to the total amount of handwritten productivity, to be regarded as significant.

Judgments of teachers and pupils. The judgments of the teachers and of the pupils yield valuable supplementary information. While a critical analysis of the opinions of teachers and pupils indicates that the judgments on particular points must be viewed with definite reservations, because of the well-known halo effect, the very existence of the halo itself is a fact of some importance. In other words, the generally favorable attitude of the teachers and of the pupils toward the typewriter, and its use in the school, doubtless influenced some of their particular judgments; but this generally favorable attitude itself indicates that, in spite of the difficulties encountered in introducing a new form of activity, the results were generally approved. The teachers regarded the use of the typewriter as beneficial to the pupils in carrying on the types of work required by the various school subjects, and they testified that the pupils overwhelmingly exhibited a lively interest and pleasure in the use of the machines. The children confirmed these observations of the teachers in their own letters. The same observations, it may be added, were made by all of those who took part in the conduct of the experiment.

A majority of the Experimental teachers judged that the classroom typewriter was compatible with the fundamental aims of elementary education, that practically all of the children's activities at the machines had some educational value, and that the typewriter was about equally helpful to bright, normal, and dull pupils. A great majority of the teachers were especially enthusiastic about the influence of the typewriter on the interests and attitudes of the pupils, such items as the following being frequently mentioned in their answers to the questionnaires: pupils come to school early and stay late in order to use the machines, wider participation in school activities involving writing, more original writing, more reading and research, the shy or slow child often "reached" by typewriters, neatness and print-like character of typing a boon to young pupils, children attracted by the typewriters as beautiful and interesting mechanisms, children's "success" with typewriters maintains their interest, typewriter promotes self-criticism on the part of pupils, typewriter develops self-confidence in slower pupils, typewriters promote independence, typewriters promote coöperativeness and mutual helpfulness in the classroom. At the end of the first year between one and four per cent of the teachers judged that the typewriter had unfavorable effects on the attitudes and interests of the children, but no teachers who had had two full years of experience with the typewriters reported any unfavorable influences on interests and attitudes.

Between 70 and 90 per cent of the teachers who had two full years of experience with the classroom typewriter judged that the typewriter had favorable influences on spelling, reading, and composition. According to these teachers the typewriter facilitates self-expression, reduces the distraction of writing, increases the amount of independent or original writing, provides clearer images of letters and words, promotes self-criticism on the part of students, and creates a "felt need" for spelling and for reading. A great majority of the teachers judge that the typewriter has an immediate and directly beneficial effect on the formal aspects of written composition, such as even margins, use of capitals and period,

indentation, use of question mark, use of quotation marks, and use of comma. More than 65 per cent of the teachers mentioned favorable effects on geography and nature study, and history and citizenship, and 53 per cent judge that the typewriter helps in arithmetic. Only 34 per cent of the teachers who have had two full years of experience with the typewriter judge that the typewriter makes a positive contribution to handwriting quality; 10 per cent judge that the typewriter has an unfavorable effect on handwriting quality; and 56 per cent either express no opinion, or judge that it has no noticeable influence on handwriting quality. Two-thirds of the teachers report that the classroom typewriter increases the pleasurableness of teaching, and 93 per cent of the teachers who had two full years of experience with the machines recommend the use of the classroom typewriter in their grades.

While this favorable attitude of teachers and pupils could not be given great weight if it did not agree in general with the results of the tests and other evidence, the fact that it harmonizes in general with the other forms of evidence strengthens both the evidence from the tests and from the judgments.

The study as a whole presents strong evidence, (1) that it is feasible to use the typewriter in the conduct of the ordinary work in the elementary school, (2) that the use of the typewriter in the informal fashion in which it was employed in this study produces an average typing speed approximately equal to the average handwriting rate in each grade, and also yields a very considerable degree of typing accuracy at the end of one year's use, (3) that the use of the typewriter stimulates elementary school pupils to produce more written material than they would otherwise produce, (4) that the classroom typewriter, as used in this experiment, entails no loss in handwriting quality or handwriting rate, (5) that it very probably raises in some measure the level of achievement in some of the fundamental school subjects, without observable loss in any subject, and finally (6) that the teachers regard the typewriter as a valuable educational instrument and approve its use in their own classes, while the pupils enjoy typewriting and look upon the typewriter with marked favor.

APPENDIX

TABLE A1

MEANS AND SIGMAS FOR EXPERIMENTAL AND CONTROL GROUPS IN GRADES ONE TO SIX OF SCORES SECURED IN SEPTEMBER 1929 ON INDICATED INTELLIGENCE AND ACHIEVEMENT TESTS, AND MEANS AND SIGMAS OF CHRONOLOGICAL AGE IN TERMS OF MONTHS

The differences between the Experimental and Control means and the probable errors of these differences are also shown. Mental age averages are shown in terms of months and are based on the Pintner-Cunningham and National Intelligence Test scores. Table A1 is based on returns from the 2383 Experimental and 3738 Control pupils in grades 1 to 6 who had complete initial and final achievement tests during the first year of the experiment.

Grade			1	2	3	4	5	6	Total
Number of cases	X		421	547	409	353	393	260	2383
	C		535	802	619	620	658	504	3738
Chronological age (months)	X	M	78.46	90.36	102.74	115.72	126.64	138.66	
		σ	7.56	8.40	10.88	11.60	12.32	10.92	
	C	M	79.70	89.56	103.14	116.30	127.94	140.02	
		σ	8.72	8.40	9.64	11.28	11.64	12.24	
Diff. $(M_x - M_c)$			1.24	.80	−.40	−.58	−1.30	−1.36	
P. E. of diff.			.351	.311	.442	.252	.513	.579	
			PINTNER-CUNNINGHAM		NATIONAL INTELLIGENCE TEST				
Intelligence test scores	X	M	26.34	38.44	47.98	64.08	79.32	96.54	
		σ	10.42	7.37	18.96	19.90	20.74	22.90	
	C	M	29.45	39.39	49.38	63.68	81.56	101.50	
		σ	9.69	7.33	18.40	20.20	20.66	21.96	
Diff. $(M_x - M_c)$			−3.11	−.95	−1.40	.40	−2.24	−4.96	
P. E. of diff.			.439	.272	.795	.440	.880	1.149	
Mental age (months)	X		75	91	103	117	128	141	
	C		79	93	104	117	131	144	
Intelligence quotient	X	M	96.78	101.46	100.24	100.96	101.70	102.26	
		σ	16.54	13.84	15.24	17.12	17.44	16.80	
	C	M	100.24	103.52	100.96	100.16	101.94	104.24	
		σ	16.38	13.26	14.22	18.16	17.44	17.42	
Diff. $(M_x - M_c)$			−3.46	−2.06	− .72	.80	−.24	−1.98	
P. E. of diff.			.740	.503	.631	.386	.741	.866	

TABLE A1 — *Continued*

INITIAL ACHIEVEMENT

		Gates Reading Tests											
		Grade 1						**Grade 2**					
		TYPE 1		TYPE 2		TYPE 3		TYPE 1		TYPE 2		TYPE 3	
		Score	Grade	Score	Grade	Score	Grade	Score	Grade	Score	Grade	Score	Grade
X	M	6.04	1.4	3.63	1.4	4.67	1.5	23.62	2.27	15.50	2.15	12.94	1.9
	σ	7.95		5.26		4.58		15.09		11.34		6.83	
C	M	3.95	1.3	4.09	1.4	3.46	1.4	20.93	2.15	14.20	2.05	11.55	1.85
	σ	6.14		6.43		3.79		14.33		11.22		6.94	
Diff. ($M_x - M_c$)		2.09	0.1	−.46	0.0	1.21	0.1	2.69	0.12	1.30	0.1	1.39	0.05
P. E. of diff.		.313		.252		.185		.547		.417		.254	

	Gates Reading		*Stanford Achievement Test*									
	Grade 1	**Grade 2**	**Grade 3**			**Grade 4**		**Grade 5**		**Grade 6**	
	AVERAGE GRADE	AVERAGE GRADE		SCORE	GRADE	SCORE	GRADE	SCORE	GRADE	SCORE	GRADE
X	1.43	2.106	M	31.79	3.1	51.28	4.1	61.72	4.9	73.10	5.9
			σ	11.37		11.20		11.16		11.90	
C	1.36	2.017	M	32.32	3.1	50.84	4.1	61.34	4.8	72.66	5.9
			σ	11.25		11.20		11.78		11.66	
Diff. ($M_x - M_c$) . . .	0.07	0.089		−.53	0.0	.44	0.0	.38	0.1	.44	0.0
P. E. of diff.				.481		.243		.484		.601	

TABLE A2

INITIAL AND FINAL ACHIEVEMENT TEST RESULTS OF 2383 EXPERIMENTAL AND 3738 CONTROL PUPILS IN GRADES 1 TO 6

The initial test was taken in September 1929, the final in May 1930. The table shows for each grade group the mean score, the standard deviation of the scores, the mean grade status, the mean gain and standard deviation of gain in score units, the mean gain in grade status, and the difference between Experimental and Control mean gains, in score points and in grade status, and the probable error of the difference in score points. The correlations between initial and final achievement test scores for the Experimental and Control groups are also shown.

Grade 1

Gates Reading Tests

		Type 1		Type 2		Type 3		Average Grade
		Score	Grade	Score	Grade	Score	Grade	
Experimental	I M	6.04	1.4	3.63	1.4	4.67	1.5	1.43
	σ	7.95		5.26		4.58		
	F M	26.36	2.33	18.88	2.3	14.79	2.1	2.24
	σ	14.67		11.52		7.15		
Gain		20.32	.93	15.25	.9	10.12	.6	.81
σ Gain		11.91		9.86		5.72		
r_{IF}		.59		.52		.60		
Control	I M	3.95	1.3	4.09	1.4	3.46	1.4	1.36
	σ	6.14		6.43		3.79		
	F M	23.41	2.23	16.43	2.15	13.17	1.9	2.09
	σ	13.84		10.28		6.83		
Gain		19.46	.93	12.34	.75	9.71	.5	.73
σ Gain		12.36		10.07		6.28		
r_{IF}		.41		.34		.42		
$G_x - G_c$		.86	0.00	2.91	0.15	.41	0.10	0.08
P. E. $(G_x - G_c)$		.53		.44		.26		

TABLE A2 — *Continued*

Grade 2

Gates Reading Tests

			Type 1		Type 2		Type 3		Average Grade
			Score	Grade	Score	Grade	Score	Grade	
X	I	M	23.62	2.27	15.50	2.15	12.94	1.9	2.106
		σ	15.09		11.34		6.83		
	F	M	39.09	3.1	28.52	3.0	21.33	2.8	2.966
		σ	10.69		7.69		4.95		
Gain			15.47	.83	13.02	.85	8.39	.9	.86
σ Gain			10.80		8.93		5.74		
r_{IF}			.70		.62		.56		
C	I	M	20.93	2.15	14.20	2.05	11.55	1.85	2.017
		σ	14.33		11.22		6.94		
	F	M	36.45	2.8	26.36	2.7	19.92	2.6	2.7
		σ	11.93		8.93		5.73		
Gain			15.52	.65	12.16	.65	8.37	.75	.683
σ Gain			10.88		9.98		6.10		
r_{IF}			.67		.53		.55		
$G_x - G_c$			−.05	0.18	.86	0.20	.02	0.15	0.18
P. E. $(G_x - G_c)$			.40		.34		.22		

Grades 3–6

			Grade 3		Grade 4		Grade 5		Grade 6	
			Stanford Primary		*Stanford Achievement Test, Advanced Examination*					
			Score	Grade	Score	Grade	Score	Grade	Score	Grade
X	I	M	31.79	3.1	51.28	4.1	61.72	4.9	73.10	5.9
		σ	11.37		11.20		11.16		11.90	
	F	M	47.83	4.0	61.24	4.8	71.12	5.7	81.18	6.8
		σ	10.37		11.20		11.66		11.78	
Gain			16.04	.9	9.96	.7	9.40	.8	8.08	.9
σ Gain			7.20		5.58		4.78		4.52	
r_{IF}			.78		.88		.91		.93	
C	I	M	32.32	3.1	50.84	4.1	61.34	4.8	72.66	5.9
		σ	11.25		11.20		11.78		11.66	
	F	M	48.10	4.0	59.68	4.7	70.34	5.7	79.34	6.6
		σ	10.42		11.84		12.32		12.18	
Gain			15.78	.9	8.84	.6	9.00	.9	6.68	.7
σ Gain			6.15		5.44		5.32		4.24	
r_{IF}			.84		.89		.90		.94	
$G_x - G_c$			.26	0.00	1.12	0.10	.40	−0.10	1.40	0.20
P. E. $(G_x - G_c)$			.30		.22		.18		.22	

TABLE A3

FIRST YEAR MEAN GAINS EXPRESSED IN GRADE UNITS, OF FIVE I. Q. GROUPS IN EACH GRADE

This table is based on the population of Tables A1 and A2.

I. Q. GROUPS		*Gates*		*Stanford Primary*		*Stanford Advanced*			UNWEIGHTED AVERAGE OF SIX GRADES
		AV. I. Q.	GRADE 1	2	3	4	5	6	AV.
I. Q. 120 +	X	127.34	1.25	.80	.9	.9	1.4	1.1	1.06
	C	128.04	.97	.85	.9	.9	1.3	.9	.97
	N_x		49	53	29	60	52	36	279
	N_c		74	81	43	95	107	95	495
I. Q. 110–119	X	113.58	1.10	1.01	.9	.9	.8	1.3	1.001
	C	113.66	.90	.90	.9	.7	.8	1.1	.883
	N_x		56	118	40	64	91	58	427
	N_c		90	203	67	94	124	103	681
I. Q. 90–109	X	98.80	.84	.87	1.0	.7	.9	.9	.868
	C	99.06	.72	.70	.9	.5	.9	.6	.72
	N_x		168	279	186	133	161	111	1038
	N_c		237	403	294	248	270	210	1662
I. Q. 80–89	X	84.44	.78	.72	.8	.7	.6	.8	.733
	C	84.76	.57	.77	.8	.6	.6	.5	.64
	N_x		69	73	102	60	48	28	380
	N_c		80	79	163	100	94	58	574
I. Q.–79	X	73.02	.49	.65	.7	.5	.5	.7	.59
	C	72.72	.55	.60	.5	.6	.4	.3	.492
	N_x		79	24	52	36	41	27	259
	N_c		54	36	52	83	63	38	326
Total	X	99.90	.80	.90	.90	.70	.80	.9	.83
	C	101.06	.70	.70	.90	.60	.90	.7	.75
	N_x		421	547	409	353	393	260	2383
	N_c		535	802	619	620	658	504	3738

TABLE A4

INITIAL AND FINAL MEAN SCORES, SIGMAS OF SCORES, MEAN GAINS AND SIGMAS OF GAINS, AND DIFFERENCES BETWEEN EXPERIMENTAL AND CONTROL MEAN GAINS AND THEIR PROBABLE ERRORS, AND INITIAL AND FINAL GRADE STATUS OF EXPERIMENTAL AND CONTROL GRADE GROUPS ON EACH SUB-TEST IN THE STANFORD ACHIEVEMENT EXAMINATION

This table is based on the populations of grades 3 to 6 described in Table A1.

Test 1 — Reading, Paragraph Meaning

	Grade 3		Grade 4		Grade 5		Grade 6		Average Gain (Grade Units)
	Score	Grade	Score	Grade	Score	Grade	Score	Grade	
X I M	30.98	3.0	50.72	4.1	60.52	4.8	72.00	5.8	
X I σ	14.63		15.12		15.34		15.38		
X F M	46.92	3.9	63.14	5.0	71.74	5.8	81.12	6.8	
X F σ	13.60		15.58		16.82		16.16		
Gain	15.94	0.9	12.42	0.9	11.22	1.0	9.12	1.0	.950
σ Gain	9.58		9.24		9.08		8.14		
r_{IF}	.77		.82		.84		.87		
C I M	31.74	3.1	50.26	4.1	60.58	4.8	71.60	5.8	
C I σ	14.19		14.70		14.88		14.18		
C F M	47.82	4.0	61.34	4.8	71.82	5.8	80.02	6.7	
C F σ	13.41		15.60		16.38		15.28		
Gain	16.08	0.9	11.08	0.7	11.24	1.0	8.42	0.9	.875
σ Gain	9.07		8.78		8.70		8.54		
r_{IF}	.78		.83		.85		.83		
$G_x - G_c$	−.14	0.00	1.34	0.2	−.02	0.00	.70	0.1	.075
P. E. $(G_x - G_c)$	.40		.40		.38		.44		

TABLE A4 — *Continued*

Test 2 — Reading, Word Meaning

			Grade 3		Grade 4		Grade 5		Grade 6		Average Gain (Grade Units)
			Score	Grade	Score	Grade	Score	Grade	Score	Grade	
X	I	M	33.30	3.1	56.60	4.5	64.44	5.1	74.72	6.1	
		σ	14.14		14.60		13.18		14.48		
	F	M	48.88	4.0	67.08	5.4	73.56	6.0	82.68	7.1	
		σ	11.67		12.14		13.24		13.08		
Gain			15.58	0.9	10.48	0.9	9.12	0.9	7.96	1.0	.925
σ Gain			10.40		8.64		7.12		5.96		
r_{IF}			.69		.80		.84		.91		
C	I	M	34.23	3.1	56.06	4.4	65.20	5.2	76.16	6.2	
		σ	13.76		13.36		13.24		13.86		
	F	M	49.18	4.0	66.06	5.3	73.62	6.0	82.34	7.0	
		σ	11.48		12.32		13.26		13.48		
Gain			14.95	0.9	10.00	0.9	8.42	0.8	6.18	0.8	.850
σ Gain			8.77		8.34		7.22		6.80		
r_{IF}			.77		.79		.85		.88		
$G_x - G_c$			.63	0.00	.48	0.00	.70	0.1	1.78	0.2	.075
P. E. $(G_x - G_c)$			.42		.38		.32		.32		

Test 3 — Dictation

			Grade 3		Grade 4		Grade 5		Grade 6		Average Gain (Grade Units)
			Score	Grade	Score	Grade	Score	Grade	Score	Grade	
X	I	M	31.40	3.0	48.70	4.0	62.34	4.9	74.22	6.0	
		σ	15.08		14.94		12.38		10.40		
	F	M	48.83	4.0	62.32	4.9	72.26	5.8	81.70	7.0	
		σ	15.04		12.86		11.60		11.68		
Gain			17.43	1.0	13.62	0.9	9.92	0.9	7.48	1.0	.950
σ Gain			9.80		7.62		6.00		5.84		
r_{IF}			.79		.86		.88		.86		
C	I	M	33.18	3.1	50.14	4.1	61.38	4.8	73.46	5.9	
		σ	14.62		14.38		13.72		11.24		
	F	M	48.52	4.0	60.46	4.7	70.56	5.7	79.44	6.6	
		σ	14.53		12.74		13.30		12.32		
Gain			15.34	0.9	10.32	0.6	9.18	0.9	5.98	0.7	.775
σ Gain			8.71		7.30		6.38		55.06		
r_{IF}			.82		.86		.89		.91		
$G_x - G_c$			2.09	0.1	3.30	0.3	.74	0.0	1.50	0.3	.175
P. E. $(G_x - G_c)$			.40		.34		.26		.26		

TABLE A4 — *Continued*

Test 4 — Language Usage

	Grade 4		Grade 5		Grade 6		Average Gain (Grade Units)
	Score	Grade	Score	Grade	Score	Grade	
X I M	51.68	4.2	60.46	4.7	71.14	5.7	
X I σ	21.48		22.20		22.68		
X F M	61.36	4.8	67.90	5.5	80.64	6.8	
X F σ	21.80		22.82		20.64		
Gain	9.68	0.6	7.44	0.8	9.50	1.1	.833
σ Gain	19.68		18.16		17.10		
r_{IF}	.58		.68		.69		
C I M	51.12	4.1	60.38	4.7	72.58	5.9	
C I σ	21.52		23.44		22.00		
C F M	58.62	4.6	67.72	5.5	78.36	6.4	
C F σ	22.76		23.24		21.88		
Gain	7.50	0.5	7.34	0.8	5.78	0.5	.600
σ Gain	19.94		18.46		16.34		
r_{IF}	.60		.69		.72		
$G_x - G_c$	2.18	0.1	.10	0.0	3.72	0.6	.233
P. E. $(G_x - G_c)$	.88		.78		.86		

Test 5 — Literature

	Grade 4		Grade 5		Grade 6		Average Gain (Grade Units)
	Score	Grade	Score	Grade	Score	Grade	
X I M	53.18	4.3	59.28	4.6	71.06	5.7	
X I σ	18.74		19.52		19.12		
X F M	60.48	4.7	68.16	5.5	81.38	6.8	
X F σ	21.04		20.40		16.38		
Gain	7.30	0.4	8.88	0.9	10.32	1.1	.800
σ Gain	21.68		19.04		16.66		
r_{IF}	.41		.54		.57		
C I M	52.02	4.2	59.14	4.6	68.70	5.6	
C I σ	18.04		19.56		19.68		
C F M	60.18	4.7	68.02	5.5	77.46	6.3	
C F σ	19.84		19.42		18.80		
Gain	8.16	0.5	8.88	0.9	8.76	0.7	.700
σ Gain	20.60		18.80		16.32		
r_{IF}	.41		.53		.64		
$G_x - G_c$	−.86	−0.1	.00	0.0	1.56	0.4	.100
P. E. $(G_x - G_c)$	.96		.80		.84		

TABLE A4 — *Continued*

Test 6 — History and Civics

			Grade 4		Grade 5		Grade 6		Average Gain (Grade Units)
			Score	Grade	Score	Grade	Score	Grade	
X	I	M	44.32	3.7	61.52	4.9	72.32	5.8	
		σ	18.76		19.52		18.10		
	F	M	57.20	4.5	70.60	5.7	78.90	6.6	
		σ	21.36		18.76		15.52		
Gain			12.88	0.8	9.08	0.8	6.58	0.8	.800
σ Gain			21.16		16.58		13.32		
r_{IF}			.45		.62		.70		
C	I	M	43.32	3.6	59.32	4.6	72.32	5.8	
		σ	19.28		21.14		17.82		
	F	M	55.96	4.4	70.34	5.7	77.04	6.3	
		σ	21.88		19.06		17.32		
Gain			12.64	0.8	11.02	1.1	4.72	0.5	.800
σ Gain			19.98		18.16		13.20		
r_{IF}			.54		.60		.72		
$G_x - G_c$			.24	0.0	−1.94	−0.3	1.86	0.3	.000
P. E. $(G_x - G_c)$			.92		.74		.68		

Test 7 — Geography

			Grade 4		Grade 5		Grade 6		Average Gain (Grade Units)
			Score	Grade	Score	Grade	Score	Grade	
X	I	M	52.72	4.3	62.58	5.0	74.80	6.1	
		σ	12.64		12.28		14.50		
	F	M	60.66	4.8	72.76	5.9	83.02	7.1	
		σ	14.72		15.22		16.96		
Gain			7.94	0.5	10.18	0.9	8.22	1.0	.800
σ Gain			10.76		11.94		10.26		
r_{IF}			.59		.64		.80		
C	I	M	51.50	4.2	63.10	5.0	74.44	6.0	
		σ	13.60		13.80		15.54		
	F	M	58.48	4.6	72.12	5.8	80.68	6.8	
		σ	15.90		16.12		17.84		
Gain			6.98	0.4	9.02	0.8	6.24	0.8	.666
σ Gain			13.92		11.12		10.30		
r_{IF}			.56		.73		.82		
$G_x - G_c$			.96	0.1	1.16	0.1	1.98	0.2	.134
P. E. $(G_x - G_c)$			.54		.50		.52		

TABLE A4 — *Continued*

Test 8 — Physiology and Hygiene

			Grade 4		Grade 5		Grade 6		Average Gain (Grade Units)
			Score	Grade	Score	Grade	Score	Grade	
X	I	M	53.86	4.3	61.68	4.9	71.42	5.7	
		σ	15.70		15.00		14.70		
	F	M	61.28	4.8	68.42	5.5	76.12	6.2	
		σ	13.30		12.34		12.76		
Gain			7.42	0.5	6.74	0.6	4.70	0.5	.533
σ Gain			13.24		12.74		12.56		
r_{IF}			.59		.58		.59		
C	I	M	51.78	4.2	61.06	4.8	69.20	5.6	
		σ	15.46		15.32		13.98		
	F	M	59.50	4.7	67.42	5.4	75.12	6.1	
		σ	13.92		13.80		12.44		
Gain			7.72	0.5	6.36	0.6	5.92	0.5	.533
σ Gain			14.72		13.22		11.56		
r_{IF}			.50		.59		.62		
$G_x - G_c$			−.30	0.0	.38	0.0	−1.22	0.0	.000
P. E. $(G_x - G_c)$			.62		.56		.64		

Test 9 — Arithmetic Reasoning

			Grade 3		Grade 4		Grade 5		Grade 6		Average Gain (Grade Units)
			Score	Grade	Score	Grade	Score	Grade	Score	Grade	
X	I	M	34.31	3.1	54.78	4.4	64.88	5.2	74.78	6.1	
		σ	16.03		15.82		13.24		11.38		
	F	M	46.61	3.9	60.54	4.8	70.38	5.7	79.26	6.6	
		σ	14.26		13.48		12.54		13.90		
Gain			12.30	0.8	5.76	0.4	5.50	0.5	4.48	0.5	.550
σ Gain			13.63		11.90		11.32		9.52		
r_{IF}			.60		.68		.62		.73		
C	I	M	34.59	3.2	54.12	4.3	64.92	5.2	74.44	6.0	
		σ	16.47		15.82		13.94		11.32		
	F	M	48.37	4.0	58.70	4.6	70.26	5.7	79.10	6.6	
		σ	13.30		14.30		12.98		12.54		
Gain			13.78	0.8	4.58	0.3	5.34	0.5	4.66	0.6	.550
σ Gain			13.21		12.64		11.04		9.08		
r_{IF}			.62		.65		.66		.72		
$G_x - G_c$			−1.48	0.0	1.18	0.1	.16	0.0	−.18	−0.1	.000
P. E. $(G_x - G_c)$			.58		.54		.48		.48		

TABLE A4 — *Continued*

Test 10 — Arithmetic Computation

			Grade 3		Grade 4		Grade 5		Grade 6		Average Gain (Grade Units)
			Score	Grade	Score	Grade	Score	Grade	Score	Grade	
X	I	M	28.42	2.9	46.50	3.9	58.54	4.6	73.46	5.9	
		σ	11.55		9.48		7.30		12.90		
	F	M	47.90	4.0	57.78	4.6	75.58	6.2	86.66	7.6	
		σ	11.22		8.28		14.60		15.90		
Gain			19.48	1.1	11.28	.7	17.04	1.6	13.20	1.7	1.275
σ Gain			11.90		7.80		12.16		10.40		
r_{IF}			.45		.62		.56		.76		
C	I	M	27.82	2.9	47.70	4.0	57.74	4.6	72.96	5.9	
		σ	11.40		9.96		7.26		12.24		
	F	M	46.66	3.9	57.58	4.6	71.42	5.7	83.46	7.1	
		σ	10.03		9.20		11.94		14.58		
Gain			18.84	1.0	9.88	.6	13.68	1.1	10.50	1.2	.975
σ Gain			11.53		9.30		10.16		11.20		
r_{IF}			.43		.53		.53		.66		
$G_x - G_c$			.64	0.1	1.40	0.1	3.36	0.5	2.70	0.5	.300
P. E. $(G_x - G_c)$			.50		.38		.48		.56		

TABLE A5

Intercorrelations of (1) Average Class Gains (September 1929 to May 1930) on Indicated Tests, (2) Ratings of Teachers, (3) Presence of Typewriters, Based on Results of All Experimental and Control Classes for Whose Teachers Ratings Were Available

The columns at the right show partial correlations which we have taken as indications of the relative influences of teachers' ratings and of presence of typewriters on test gains.

Grades 1 and 2

36 Experimental Classes and 49 Control Classes

Variables Correlated	Means of Class Means			Sigmas of Class Means			Correlations with		Influence of	
	X+C	X	C	X+C	X	C	Ratings	Typewriter	Teachers $r_{12.3}$	Typewriter $r_{13.2}$
2 Teachers' ratings	1.922	1.594	2.163	.751	.572	.776				
3 Presence of Typewriter	.42			.49			.37			
Gains on:										
1 Gates I	18.00	17.80	18.15	6.60	6.29	6.83	.21	−.03	.24±.07	−.11±.07
1 Gates II	13.22	14.03	12.62	5.93	5.03	6.44	.35	.12	.34±.06	−.02±.07
1 Gates III	9.36	9.19	9.48	3.56	2.93	3.96	.28	−.04	.32±.06	−.16±.07

TABLE A5 — *Continued*

Grade 3

16 Experimental Classes and 25 Control Classes

Variables Correlated	Means of Class Means			Sigmas of Class Means			Correlations with		Influence of	
	X+C	X	C	X+C	X	C	Ratings	Typewriter	Teachers $r_{12.3}$	Typewriter $r_{13.2}$
2 Teachers' ratings .	1.780	1.737	1.808	.727	.720	.730				
3 Presence of Typewriter	.39			.49			.05			
Gains on:										
1 Test 1. Reading — par. mean. . . .	16.45	16.25	16.58	3.45	3.15	3.62	.06	−.05	.06±.10	−.05±.10
1 Test 2. Reading — word mean. . .	15.60	15.69	15.34	3.63	4.00	3.93	−.03	.00	−.03±.10	.00±.10
1 Test 3. Dictation (spelling) . . .	16.67	18.00	15.74	4.03	4.34	3.53	−.11	.29	−.13±.10	.30±.10
1 Test 4. Arith. reasoning . . .	13.26	12.87	13.50	4.21	4.21	4.19	−.15	−.07	−.15±.10	−.07±.10
1 Test 5. Arith. computation . .	20.01	20.56	19.66	5.83	5.59	5.94	.24	.07	.24±.10	.07±.10
1 Total, Stanford prim. test . . .	16.28	16.56	16.10	2.67	2.22	2.91	.08	.08	.08±.10	.08±.10

Grades 4–5–6

30 Experimental Classes and 57 Control Classes

Variables Correlated	Means of Class Means			Sigmas of Class Means			Correlations with		Influence of	
	X+C	X	C	X+C	X	C	Ratings	Typewriter	Teachers $r_{12.3}$	Typewriter $r_{13.2}$
2 Teachers' ratings .	1.807	1.680	1.874	.756	.612	.814				
3 Presence of typewriter	.34			.47			.12			
Gains on:										
1 Test 1. Reading — par. mean. . . .	10.34	10.77	10.11	3.35	3.41	3.30	.11	.09	.10±.07	.08±.07
1 Test 2. Reading — word meaning .	8.67	9.30	8.34	2.83	2.09	3.10	.14	.16	.12±.07	.15±.07
1 Test 3. Dictation (spelling) . . .	9.66	11.23	8.83	3.72	3.85	3.36	−.06	.31	−.11±.07	.32±.06
1 Test 4. Language usage	7.70	8.70	7.17	5.00	4.28	5.27	.15	.15	.13±.07	.13±.07
1 Test 5. Literature	8.92	8.63	9.08	4.84	5.67	4.33	−.04	−.04	−.04±.07	−.04±.07
1 Test 6. History and civics . . .	9.95	9.83	10.01	6.97	6.50	7.21	.09	−.01	.09±.07	−.02±.07
1 Test 7. Geography	8.53	9.73	7.90	4.23	4.62	3.86	.19	.21	.17±.07	.19±.07
1 Test 8. Physiology, hygiene	7.23	7.10	7.31	3.64	3.55	3.68	−.13	−.03	−.13±.07	−.01±.07
1 Test 9. Arith. reasoning . . .	5.77	5.83	5.74	4.04	3.53	4.28	−.03	.01	−.04±.07	.01±.07
1 Test 10. Arith. computation . .	12.82	14.33	12.03	6.01	6.86	5.33	.08	.18	.06±.07	.17±.07
1 Total, Stanford Adv. Test . . .	8.73	9.27	8.45	2.22	2.06	2.25	.12	.17	.10±.07	.16±.07

TABLE A6

INITIAL AND FINAL HANDWRITING QUALITY AND RATE MEDIANS AND SEMI-INTERQUARTILE RANGES OF TOTAL AND MATCHED EXPERIMENTAL AND CONTROL GROUPS IN GRADES 1 TO 6

The total groups include all cases in the six cities that had a handwriting test on the dates indicated; the matched groups in each grade include only cases that had both initial (September 1929) and final (May 1930) handwriting tests in the six cities. The quality is expressed in terms of Ayres scale units and the rate in terms of words per minute.

HANDWRITING QUALITY AND RATE

		Grade 1					Grade 2					Grade 3				
		N	Quality		Rate		*N*	Quality		Rate		*N*	Quality		Rate	
			Mdn	Q	Mdn	Q		Mdn	Q	Mdn	Q		Mdn	Q	Mdn	Q
Matched	X Sept. 1929	186	22	6	1.6	.6	409	29	7	3.5	1.0	367	41	7	5.3	1.4
	X May 1930		28	7	3.3	1.2		33	6	5.5	1.0		39	7	7.6	1.7
Matched	C Sept. 1929	199	23	4	1.5	1.4	555	29	6	3.2	.8	426	42	8	7.3	2.1
	C May 1930		25	4	2.4	.7		33	7	4.0	1.1		40	7	6.5	1.3
Total	X Sept. 1929	269	22	5	1.6	.5	475	29	8	3.5	.9	487	41	7	5.2	1.4
	X May 1930	555	26	6	2.6	1.0	534	34	7	5.4	1.6	439	39	7	7.7	1.8
Total	C Sept. 1929	270	23	4	1.5	.4	775	29	7	3.2	.9	687	42	8	7.2	2.3
	C May 1930	866	22	7	1.8	.8	778	33	7	4.1	1.3	599	39	7	6.9	1.5

		Grade 4					Grade 5					Grade 6					Total *N*
Matched	X Sept. 1929	291	40	6	7.6	2.5	312	42	8	8.8	2.6	180	43	7	10.0	2.2	1745
	X May 1930		38	7	9.3	2.0		41	8	10.7	1.9		46	8	12.6	3.1	
Matched	C Sept. 1929	521	35	7	8.1	2.3	509	40	8	9.4	2.5	357	41	9	11.8	2.4	2567
	C May 1930		36	8	8.3	1.8		41	8	10.3	1.7		44	11	11.1	2.0	
Total	X Sept. 1929	415	40	6	7.3	2.3	438	43	8	8.4	2.2	195	43	6	10.2	2.3	2279
	X May 1930	379	39	7	9.5	1.9	380	41	8	10.7	1.8	293	45	8	12.6	3.2	2600
Total	C Sept. 1929	740	38	8	7.9	2.1	710	41	8	9.2	2.3	543	42	9	11.5	2.4	3725
	C May 1930	585	36	8	8.2	1.7	646	42	8	10.2	1.6	436	43	10	12.3	2.1	3910

TABLE A7

MEDIANS AND SEMI-INTERQUARTILE RANGES FOR INITIAL AND FINAL TYPING RATE AND ERROR INDEX AND HANDWRITING RATE, FOR INDICATED GROUPS OF EXPERIMENTAL PUPILS

The first matched group includes all cases in the six cities that had both initial (December 1929) and final (May 1930) typewriting tests. The second matched group includes cases that had both typewriting and handwriting tests in May 1930. The typing rate and handwriting rate are expressed in terms of words per minute and the error index is percentage of errors.

TYPEWRITING RATE AND ERROR INDEX

		Grade 1					Grade 2					Grade 3				
		N	Rate		Error Index		*N*	Rate		Error Index		*N*	Rate		Error Index	
			Mdn.	Q	Mdn.	Q.		Mdn.	Q.	Mdn.	Q.		Mdn.	Q.	Mdn.	Q.
Matched	Typing X Dec. 1929	345	2.4	.9	9.0	6.1	450	3.3	1.0	8.5	5.7	339	4.5	1.1	7.0	4.4
	Typing X May 1930		3.8	1.3	5.1	4.6		5.2	1.7	4.5	4.0		7.0	2.1	4.0	2.9
Matched	Typing X May 1930	480	3.5	1.1			444	4.7	1.6			313	6.1	1.7		
	Hand X May 1930		2.8	.9				5.4	1.6				7.4	1.7		

		Grade 4					Grade 5					Grade 6					Total
		N	Rate		Error Index		*N*	Rate		Error Index		*N*	Rate		Error Index		*N*
			Mdn.	Q.	Mdn.	Q.		Mdn.	Q.	Mdn.	Q.		Mdn.	Q.	Mdn.	Q.	
Matched	Typing X Dec. 1929	324	5.8	1.2	5.6	3.4	362	6.1	1.3	5.0	2.8	237	7.8	1.7	4.0	3.4	2057
	Typing X May 1930		8.8	2.3	3.3	2.6		9.2	2.0	3.0	2.1		12.0	3.4	3.0	1.7	
Matched	Typing X May 1930	337	8.2	2.2			317	8.9	2.1			252	10.3	3.7			2143
	Hand X May 1930		9.2	1.6				11.4	1.8				12.4	2.3			

TABLE A8

SEPTEMBER 1929 CHRONOLOGICAL AGE, MENTAL AGE, AND INTELLIGENCE QUOTIENT MEANS AND SIGMAS OF SECOND-YEAR EXPERIMENTAL PUPILS IN EACH GRADE

Grade		1	2	3	4	5
Number of cases		371	333	281	259	254
Chronological age (months)	M	78	89	102	114	125
	σ	7	8	10	11	12
		Pintner-Cunningham		National Intelligence Test		
Intelligence Test Scores	M	27.2	39.0	48.3	65.88	80.88
	σ	10.3	7.3	19.0	20.30	20.56
Mental age (months)	M	76	93	103	118	130
Intelligence quotient	M	99	104	101	103	104
	σ	17	14	15	16	17

TABLE A9

ACHIEVEMENT TEST DATA OF SEPTEMBER 1929, MAY 1930, AND MAY 1931 FOR SECOND-YEAR EXPERIMENTAL GRADE GROUPS

The numbers of cases are the same as in Table A8. The grade designation given above each group of figures is the 1929–30 grade location; the 1930–31 or second-year grade location is indicated at the left of the last line or below each group of figures. Note that grade 2–3 pupils took the Gates test in 1929–30, and the Primary Stanford in 1931; and that the grade 3–4 group took the Primary Stanford in 1929–30, and the Advanced Stanford in 1931.

Grade 1

Gates Reading Test

		Type 1		Type 2		Type 3		Average Grade	Gains (Grade Units)
		Score	Grade	Score	Grade	Score	Grade		
Sept. 1929	M	6.5	1.4	3.9	1.4	4.8	1.5	1.43	
	σ	8.3		5.6		4.7			
May 1930	M	27.6	2.4	19.8	2.35	15.4	2.1	2.28	.85
	σ	14.2		11.4		6.9			
May 1931 (Grade 2)	M	40.3	3.2	29.6	3.1	21.5	3.0	3.1	.82
	σ	9.2		6.8		4.3			

Grade 2

Gates Reading Test

		Type 1		Type 2		Type 3		Average Grade	Gains (Grade Units)
		Score	Grade	Score	Grade	Score	Grade		
Sept. 1929	M	22.1	2.2	14.5	2.1	12.1	1.85	2.05	
	σ	14.7		11.3		6.8			
May 1930	M	39.4	3.1	28.7	3.0	21.6	3.0	3.03	.98
	σ	9.5		7.2		4.7			

Stanford Primary

May 1931 (Grade 3)	M	47.1	3.9	.87
	σ	10.6		

		Grade 3 (Stanford Primary)			Grade 4 (Stanford Advanced)			Grade 5 (Stanford Advanced)		
		Score	Grade	Gains (Grade Units)	Score	Grade	Gains (Grade Units)	Score	Grade	Gains (Grade Units)
Sept. 1929	M	32.1	3.1		52.1	4.2		62.4	4.9	
	σ	11.3			11.3			11.0		
May 1930	M	48.6	4.0	0.90	62.1	4.9	0.7	71.3	5.7	.8
	σ	9.9			11.0			11.6		
		(Stanford Advanced)								
May 1931	M	62.4	4.9	0.90	75.3	6.1	1.2	82.2	7.0	1.3
	σ	11.4			11.5			11.8		
		(Grade 4)			(Grade 5)			(Grade 6)		

TABLE A10

MAY 1930 AND MAY 1931 MEDIANS AND SEMI-INTERQUARTILE RANGES OF INDICATED GROUPS OF SECOND-YEAR EXPERIMENTAL PUPILS IN HANDWRITING QUALITY AND RATE, AND TYPING RATE AND ERROR INDEX

HANDWRITING QUALITY AND RATE

		Grade 1					Grade 2					Grade 3				
		N	Quality		Rate		*N*	Quality		Rate		*N*	Quality		Rate	
			Mdn.	Q.	Mdn.	Q.		Mdn.	Q.	Mdn.	Q.		Mdn.	Q.	Mdn.	Q.
Matched	Hand X May 1930	281	26	6	2.7	.9	352	32	7	4.9	1.6	319	40	7	7.5	2.2
	Hand X May 1931						281	34	8	6.3	1.5	352	36	7	7.8	1.6

Grade 4					Grade 5					Grade 6					Total
N	Quality		Rate		*N*	Quality		Rate		*N*	Quality		Rate		*N*
	Mdn.	Q.	Mdn.	Q.		Mdn.	Q.	Mdn.	Q.		Mdn.	Q.	Mdn.	Q.	
261	37	6	9.2	1.9	251	41	7	10.4	1.7						
319	43	8	8.9	1.7	261	40	7	12.6	2.1	251	47	8	13.6	1.7	1464

TYPEWRITING RATE AND ERROR INDEX

		Grade 1					Grade 2					Grade 3				
		N	Rate		Error Index		*N*	Rate		Error Index		*N*	Rate		Error Index	
			Mdn.	Q.	Mdn.	Q.		Mdn.	Q.	Mdn.	Q.		Mdn.	Q.	Mdn.	Q.
Matched	Typing X May 1930	421	3.4	1.1	5.2	3.3	518	4.5	1.7	4.8	3.0	322	6.4	1.9	4.1	2.6
	Typing X May 1931						421	4.1	1.5	4.6	2.8	518	6.8	1.9	3.9	2.5

Grade 4					Grade 5					Grade 6					Total
N	Rate		Error Index		*N*	Rate		Error Index		*N*	Rate		Error Index		*N*
	Mdn.	Q.	Mdn.	Q.		Mdn.	Q.	Mdn.	Q.		Mdn.	Q.	Mdn.	Q.	
291	8.6	2.2	3.3	1.6	326	9.0	2.0	3.2	1.6						
322	8.4	1.9	3.3	1.6	291	10.1	2.2	3.3	1.6	326	11.9	2.8	3.1	1.5	1878

TABLE A11

Reliability Coefficients of the Typing Rate and Error Tests

Two forms of the test, F_1 and F_2, were given in a majority of the Experimental classes in May 1931 to both one- and two-year Typewriter pupils. All grade 1 pupils, with rare exceptions, were new to the typewriters in September 1930 and a few entered the typewriting classes as late as the spring of 1931. Note the difference between the mean and the median in grade 1. The error index medians in grade 1 here are higher than in Table A7 above because some of the first-grade pupils who took these tests had had only a few months of experience with the machines. In grade 1 the means are considerably higher than the medians because the distributions are skewed.

	Rate of Typing						Error Index				
	N	F_1		F_2		r_{12}	F_1		F_2		r_{12}
		M	σ	M	σ		M	σ	M	σ	
Grade 1	347	3.10	1.77	3.22	1.75	0.88	13.97 (7.06)	18.75	12.86 (6.75)	17.84	0.83
Grade 2	394	5.07	2.33	5.05	2.32	0.86	4.51	3.29	4.62	3.38	0.62
Grade 3	428	7.37	3.10	7.47	3.33	0.93	4.21	2.92	3.88	2.76	0.64
Grade 4	326	8.74	3.37	9.31	3.56	0.90	3.52	2.64	3.23	2.60	0.60
Grade 5	310	10.86	3.78	10.53	3.68	0.87	3.24	2.05	3.37	2.34	0.55
Grade 6	270	14.00	5.07	14.67	5.43	0.70	2.90	1.90	3.07	2.12	0.57

TABLE A12

Quantity of Writing Done by Experimental and Control Grade Groups in Four Cities in 1929–30

The index of quantity used here, "words per pupil," has statistical limitations which must be kept in mind in appraising the indications of the table. In each classification of writings the median length of the pieces was multiplied by the number of pieces, and this product divided by the number of pupils in the group is taken as the quantity index "words per pupil."

Words per Pupil

	Grade	1	2	3	4	5	6
X	Total	3493	5671	7455	12901	14229	12990
X	Handwritten	1430	3256	5618	8404	10755	10059
C	Total	594	2498	6487	9835	13089	12207
X	Total original	295	1076	1592	3267	4071	4732
X	Hand. original	152	462	924	1495	2772	3676
C	Total original	4	98	917	2662	2887	4050
X	Total practice	900	879	1115	1287	1706	841
X	Hand. practice	445	664	1005	1190	1628	791
C	Total practice	237	1150	2364	2940	4350	4057
X	Total N, L — copied	1873	2157	3319	7361	9236	7920
X	Hand. N, L — copied	602	923	2255	4744	7186	5965
C	Total N, L — copied	173	986	2108	3145	5224	4376
X	Total arithmetic	697	2360	1600	1200	800	875
X	Hand. arithmetic	328	1841	1500	1100	765	800
C	Total arithmetic	151	456	1800	800	1200	625
X	Number of	193	215	242	210	212	204
C	pupils	194	310	208	225	225	251

TABLE A13

INTERCORRELATIONS OF (1) CLASS AVERAGES OF NUMBER OF WORDS WRITTEN PER PUPIL (SEPTEMBER 1929 TO MAY 1930), (2) RATINGS OF TEACHERS, (3) PRESENCE OF TYPEWRITERS, IN INDICATED NUMBERS OF EXPERIMENTAL AND CONTROL CLASSES IN GRADES 1 TO 6

The columns at the right show partial correlations which we have taken as indications of the relative influences of teachers' ratings and of presence of typewriters on test gains.

CLASS AVERAGES: WORDS PER PUPIL

	NUMBER OF CLASSES			MEAN			SIGMA			r's WITH			$r_{12.3}$	$r_{13.2}$
	X+C	X	C	X+C	X	C	X+C	X	C	RATING	WORDS	TYPE		
Grade 1														
1. Words per pupil	12	4	8	2067	3950	1125	1579	994	764	.37		.84		
2. Teacher rating	12	4	8	2.717	2.300	2.925	.709	.671	.632		.37	.41	.05 ± .19	.82 ± .07
3. Typewriter	12	4	8	.33			.47			.41	.84			
Grade 2														
1. Words per pupil	12	4	8	4167	6800	2850	3160	3821	1574	.71		.59		
2. Teacher rating	12	4	8	2.367	2.150	2.475	.752	.853	.670		.71	.20	.75 ± .08	.65 ± .11
3. Typewriter	12	4	8	.33			.47			.20	.59			
Grade 3														
1. Words per pupil	14	6	8	6600	8200	5400	4124	4206	3625	.17		.34		
2. Teacher rating	14	6	8	2.071	2.333	1.875	.579	.427	.599		.17	− .39	.35 ± .16	.45 ± .14
3. Typewriter	14	6	8	.43			.49			− .39	.34			
Grade 4														
1. Words per pupil	11	4	7	9954	14550	7328	7368	9211	4227	− .12		.47		
2. Teacher rating	11	4	7	2.273	1.950	2.457	1.028	.384	1.217		− .12	.24	− .27 ± .19	.52 ± .15
3. Typewriter	11	4	7	.36			.48			.24	.47			
Grades 5 and 6														
1. Words per pupil	32	11	21	11981	13991	10928	5478	6517	4502	.02	.02	− .28		
2. Teacher rating	32	11	21	2.069	2.364	1.914	.756	.835	.661	− .28	.26	.26	.11 ± .12	.28 ± .11
3. Typewriter	32	11	21	.34			.47							

TABLE A14

AVERAGE NUMBERS OF PIECES OF INDICATED KINDS OF WRITING DONE BY EXPERIMENTAL AND CONTROL GROUPS IN 1929–30

The probable errors of the differences between Experimental and Control averages are shown below in Table A16.

PIECES PER PUPIL

GRADE	1	2	3	4	5	6
X Total	106	128	147	205	239	200
X Handwritten	50	75	111	135	179	157
C Total	35	88	138	190	209	191
X Total original	11	28	29	45	51	50
X Hand. original	4	15	17	21	33	39
C Total original	1	3	19	37	41	46
X Number of	193	215	242	210	212	204
C pupils	194	310	208	225	225	251

TABLE A15

MEDIAN AND QUARTILE LENGTHS OF PIECES OF INDICATED KINDS OF WRITING DONE BY EXPERIMENTAL AND CONTROL GROUPS IN 1929–30

The probable errors of the differences between Experimental and Control medians are shown in Table A16.

LENGTH OF PIECES IN WORDS

	GRADES	1			2			3		
		Q_1	Md.	Q_3	Q_1	Md.	Q_3	Q_1	Md.	Q_3
X	Handwritten	18.4	28.4	42.7	26.8	43.4	72.2	35.2	50.8	75.8
X	Typewritten	22.4	38.5	68.2	27.3	45.6	73.4	31.4	50.0	74.3
C	Total	12.0	16.9	26.6	17.5	28.3	40.0	35.8	47.0	66.3
X	Original	12.8	25.8	52.1	22.8	38.2	58.7	37.7	54.4	73.8
X	Copied	21.2	33.5	52.8	28.4	46.2	77.1	33.8	49.4	76.3
C	Original	3.4	6.8	11.0	25.0	34.0	45.8	34.6	48.1	69.9
C	Copied	12.2	17.0	26.8	17.2	28.0	39.8	36.1	46.9	65.3

	GRADES	4			5			6		
X	Handwritten	43.4	62.1	91.3	48.6	60.2	86.1	50.0	64.0	105.8
X	Typewritten	43.7	64.6	97.8	38.3	56.4	76.4	45.1	68.0	115.3
C	Total	29.9	51.7	67.7	37.6	62.8	101.2	35.3	63.8	108.1
X	Original	50.6	73.4	108.7	50.8	79.4	118.0	58.2	94.5	145.3
X	Copied	42.0	60.2	89.3	45.1	57.4	74.2	47.0	59.0	93.2
C	Original	51.5	72.8	103.4	41.5	70.1	110.9	56.6	87.6	139.1
C	Copied	24.0	48.8	58.9	36.8	60.9	99.0	29.3	56.6	119.2

	GRADES	1	2	3	4	5	6
X	Number	193	215	242	210	212	204
C	of cases	194	310	208	225	225	251

TABLE A16

PROBABLE ERRORS OF DIFFERENCES BETWEEN AVERAGE NUMBERS OF PIECES WRITTEN AND BETWEEN MEDIAN LENGTHS OF PIECES WRITTEN BY EXPERIMENTAL AND CONTROL GROUPS

The probable errors here were calculated by the formula P.E. $(M_x - M_c) = .6745\sqrt{\frac{\sigma^2_x}{N_x} + \frac{\sigma^2_c}{N_c}}$ in which the M's are the means of Experimental and Control class means, the sigmas under the radical are the sigmas of the distributions of Experimental and Control class means, and the N's are the numbers of Experimental and Control classes in each grade.

GRADE	N CLASSES		N PUPILS	
	X	C	X	C
1	7	11	193	354
2	6	11	215	402
3	7	8	237	257
4	6	9	210	304
5	6	12	212	360
6	6	9	204	343

GRADE	CLASS MEANS		SIGMA OF DISTRIBUTION OF CLASS MEANS		DIFFERENCE $(M_x - M_c)$	P.E. DIFFERENCE	CRITICAL RATIO
	X	C	X	C			
Total Pieces Written per Pupil							
1	97.04	45.00	33.56	41.62	52.04	11.90	4.373
2	126.36	83.39	51.10	54.00	42.97	17.65	2.435
3	144.12	118.08	49.80	72.70	26.04	21.25	1.225
4	163.29	195.45	102.90	95.20	−32.16	35.11	.916
5	217.28	163.23	66.75	77.80	54.05	23.55	2.295
6	197.88	154.31	73.71	61.82	43.57	24.32	1.792
Median Length of All Pieces							
1	36.99	16.28	6.39	4.81	20.71	1.88	11.016
2	41.41	26.77	11.18	5.82	14.64	3.26	4.491
3	49.90	43.99	12.21	8.20	5.91	3.63	1.628
4	62.82	56.61	13.67	12.91	6.21	4.70	1.321
5	60.36	66.92	8.37	13.61	−6.56	3.47	1.890
6	68.81	75.47	20.95	18.71	−6.66	7.06	.943
Total Original Pieces per Pupil							
1	9.08	1.97	11.91	2.87	7.11	3.09	2.301
2	33.42	3.56	30.00	3.86	29.86	8.20	3.641
3	31.23	22.64	20.60	11.30	8.59	5.83	1.473
4	42.87	37.76	19.15	19.20	5.11	6.74	.758
5	48.54	28.07	21.15	24.91	20.47	7.49	2.733
6	54.81	49.83	45.83	17.64	4.98	13.08	.381
Median Length of Original Pieces							
1	31.44	17.28	10.00	11.44	14.16	3.45	4.104
2	39.44	38.58	11.43	24.79	.86	5.94	.145
3	55.87	49.27	17.76	11.46	6.60	3.33	1.982
4	73.66	76.02	12.13	11.97	−2.36	4.24	.557
5	80.23	78.74	11.27	15.21	1.49	4.23	.352
6	96.03	92.10	19.51	13.74	3.93	13.36	.294

TABLE A17

FIRST- AND SECOND-YEAR WRITING PRODUCTIVITIES OF TWO-YEAR TYPEWRITER GROUPS IN GRADES 1 TO 6

WORDS PER PUPIL

		1	2	3	4	5	6
X	Total 1930	4305	6854	9042	15635	15269	
X	Total 1931	4560	6458	12441	16253	20766	26077
X	Total typed — 1930 . . .	2550	2935	2186	5387	3391	
X	Total hand. — 1930 . . .	1892	3932	6855	10289	11889	
X	Total typed — 1931 . . .	2875	3983	2685	3625	2504	4453
X	Total hand. — 1931 . . .	1956	2847	9694	12679	18299	21629
X	Total orig. — 1930 . . .	429	1778	2022	3759	4035	
X	Hand. orig. — 1930 . . .	219	796	1179	1789	2842	
X	Typed orig. — 1930 . . .	184	998	847	2007	1193	
X	Total orig. — 1931 . . .	114	1520	1965	3639	5582	8730
X	Hand. orig. — 1931 . . .	44	339	947	2185	4242	5836
X	Typed orig. — 1931 . . .	77	1214	1060	1459	1345	2870

PIECES PER PUPIL

		1	2	3	4	5	6
X	Total 1930	133	154	175	241	248	
X	Total hand. — 1930 . . .	67	90	132	162	190	
X	Total 1931	140	152	239	275	277	294
X	Total hand. — 1931 . . .	75	81	192	220	247	242
X	Total orig. — 1930 . . .	15	45	37	49	49	
X	Hand. orig. — 1930 . . .	6	24	22	25	34	
X	Total orig. — 1931 . . .	5	26	32	48	59	84
X	Hand. orig. — 1931 . . .	2	8	17	29	45	58
	Number of pupils — 1930 . . .	95	100	125	120	130	
	1931 . . .	10	95	100	125	120	130

TABLE A18

MEDIAN AND QUARTILE LENGTH OF PIECES WRITTEN IN THE FIRST AND IN THE SECOND YEAR BY IDENTICAL GROUPS OF TWO-YEAR TYPEWRITER PUPILS

LENGTH OF PIECES

GRADE	1			2			3		
	Q_1	Md.	Q_3	Q_1	Md.	Q_3	Q_1	Md.	Q_3
X Hand. — 1930	18.5	28.1	42.1	27.2	43.5	71.8	35.9	51.8	76.6
X Type. — 1930	22.8	38.9	66.0	27.7	46.5	75.9	32.5	51.5	77.5
X Orig. hand. — 1930	21.6	38.4	53.2	19.8	33.5	50.7	37.9	53.3	71.6
X Orig. type. — 1930	10.1	19.7	48.0	30.4	47.4	72.9	38.3	55.8	78.3
X Hand. — 1931	16.2	26.3	39.0	22.4	34.9	51.7	33.3	50.4	78.3
X Type. — 1931	26.6	43.7	80.0	36.3	56.3	86.7	39.6	57.7	86.9
X Orig. hand. — 1931	12.9	19.3	25.8	30.0	41.2	62.7	39.2	56.7	82.9
X Orig. type. — 1931	19.7	30.7	45.6	43.9	66.9	107.4	47.3	67.8	103.6

GRADE	4			5			6		
X Hand. — 1930	44.3	63.4	94.0	49.6	62.7	88.7			
X Type. — 1930	45.8	68.1	103.6	39.6	58.4	84.4			
X Orig. hand. — 1930	49.4	72.2	95.4	55.8	84.3	125.1			
X Orig. type. — 1930	54.7	82.2	124.1	53.4	80.5	118.1			
X Hand. — 1931	40.5	57.7	86.0	45.7	74.0	120.8	55.2	89.2	136.9
X Type. — 1931	46.5	66.2	96.0	54.0	82.8	131.9	54.8	86.8	135.4
X Orig. hand. — 1931	52.4	74.7	101.8	62.5	93.8	141.3	61.4	100.8	155.9
X Orig. type. — 1931	54.5	77.5	113.7	64.6	97.6	147.3	69.8	110.9	162.8

GRADES	1	2	3	4	5	6
Number of cases — 1929–30	95	100	125	120	130	
1930–31	10	95	100	125	120	130

TABLE A19

CORRELATIONS BETWEEN AVERAGE OF WORDS WRITTEN PER PUPIL AND AVERAGE TEST GAINS DURING THE FIRST YEAR FOR INDICATED NUMBERS OF CLASSES IN EACH GRADE

All Experimental and Control classes are included whose first-year writings were analyzed as explained in Chapter IV. (See page 63.)

		NUMBER OF CLASSES	MEAN	SIGMA	r_{12}	P.E.$_r$
Grade 1						
2 Words per pupil		15	2020	1519		
1 Average class gains	Gates I	15	15.70	6.62	.28	.14
1 Average class gains	Gates II	15	10.83	5.72	.18	.15
1 Average class gains	Gates III	15	9.30	3.35	.33	.14
Grade 2						
2 Words per pupil		15	3480	3217		
1 Average class gains	Gates I	15	16.43	5.97	.49	.12
1 Average class gains	Gates II	15	12.37	7.07	.27	.14
1 Average class gains	Gates III	15	8.30	4.12	.34	.14
Grade 3						
2 Words per pupil		14	6600	4124		
1 Average class gains	Stan. Prim. Total	14	15.86	3.24	.40	.13
Grade 4						
2 Words per pupil		13	11054	6654		
1 Average class gains	Stan. Adv. Total	13	9.04	2.27	.27	.15
Grade 5						
2 Words per pupil		18	11500	4521		
1 Average class gains	Stan. Adv. Total	18	9.50	2.11	.20	.14
Grade 6						
2 Words per pupil		15	12420	6271		
1 Average class gains	Stan. Adv. Total	15	7.43	2.11	.30	.14
Grade 4						
2 Words per pupil		13	11054	6654		
1 Average class gains by grade units Stanford Test 2, Word Meaning		13	.93	.24	−.08	.15
1 Average class gains by grade units Stanford Test 3, Spelling		13	.90	.28	.63	.09
1 Average class gains by grade units Stanford Test 10, Arithmetic Computation		13	.67	.26	.17	.15
Grade 5						
2 Words per pupil		18	11500	4521		
1 Average class gains by grade units Stanford Test 2, Word Meaning		18	.84	.27	.46	.11
1 Average class gains by grade units Stanford Test 3, Spelling		18	1.02	.32	.28	.14
1 Average class gains by grade units Stanford Test 10, Arithmetic Computation		18	1.60	.80	−.29	.14
Grade 6						
2 Words per pupil		15	12420	6271		
1 Average class gains by grade units Stanford Test 2, Word Meaning		15	.76	.31	.00	.16
1 Average class gains by grade units Stanford Test 3, Spelling		15	.85	.29	.30	.14
1 Average class gains by grade units Stanford Test 10, Arithmetic Computation		15	1.49	.62	.21	.14

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